APPLICATION FOR

UNITED STATES LETTERS PATENT

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

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have invented a new and useful BEAR DERIVED ISOLATE AND METHOD of which the following is a specification.

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CROSS-REFERENCE TO RELATED APPLICATIONS:

The present application is a continuation-in-part of pending application Serial No. 08/470,750 filed June 6, 1995 by the same inventors herein and entitled "Fasting Bear Isolate and Method", abandoned; which application in turn is a continuation-in-part of Serial No. 08/259,788, filed June 14, 1994 and entitled "Denning Bear Isolate and Method" by the same inventors herein, abandoned; and is a continuation-in-part of original application Serial No. 08/079,089, filed June 16, 1993 entitled "Denning Bear Isolate and Method", abandoned.

I. FIELD OF INVENTION

The present invention relates to the discovery and isolation of a substance called bear derived isolate (BDI) which can be found in fasting and denning black bears which, in combination and with various carriers and various doses, based upon studies conducted with guinea pigs, bone cultures, and rats, will likely have beneficial results on humans in promoting bone growth in those persons having osteoporosis, in conserving nitrogen to a point where hemodialysis and kidney transplants need not be done in patients with chronic or end stage renal disease, in inhibiting protein breakdown in humans suffering burns and trauma, in permitting long-term flights into space by conserving bone integrity and preventing muscular atrophy, and in producing weight loss in obese subjects in the form of fat reduction while conserving lean body mass and promoting tranquility while in an alert state at normal body temperature. A related aspect of the invention is directed to a method of the isolation and purification of the bear derived isolate, whether from a fasting bear or a denning bear, to a form where predictable results in the above phenomena are readily achieved alone or in combination with other known metabolic substances. The further discovery that a fasting or otherwise normal summer bear, as distinguished from a denning bear, will produce the equivalent of a bear derived isolate (BDI) requires that this invention be considered in terms of a fasting bear, despite the fact that the bulk of the investigation has evolved around the isolate from a denning bear.

A better understanding of the field of invention, the invention itself, and the description of preferred embodiments will follow from an understanding of the definitions of various terms which are used, and which appear in the following "Glossary of Terms".

GLOSSARY OF TERMS

Aliquot: A specified portion.

Alkaline Phosphatase Activity: Activity of this enzyme increases in bone as part of osteoblastic stimulation of bone growth.

Anorexia: Loss of appetite.

Aqueous Fraction: That portion containing water.

Bone Remodeling: A function of bone in which osteoblasts form bone and osteoclasts resorb bone. Positive bone remodeling occurs when the osteoblastic activity exceeds the osteoclastic activity; or when the osteoclastic activity is diminished; or where the osteoblastic activity is increased. In any of these events there is a positive addition to bone. Negative bone remodeling occurs when the osteoclastic activity outstrips the osteoblastic activity, or the osteoblastic activity is reduced from its normal balance with the osteoclastic activity; and any combination of the foregoing.

Bone Resorption: Occurs when bone is subjected to osteoclastic activity.

Countercurrent Chromatography (CCC): A technique used to separate substances of different molecular characteristics by using solvents of aqueous and organic properties with centrifugation. Some substances are retained on the coil while others pass through.

Deproteination: Subject the sample to any of various procedures for removing all or part of the original protein in the sample.

Differentiation: To develop into specialized organs or cells.

Eluted: Drawn down, through or off (e.g. liquid through a filter).

Eluted Isocratically: Separate substances off of a column using one solvent system without changing concentration of that solvent system.

Fasting: A voluntary or involuntary state represented by states of non-ingesting, hypophagia, or anorexia. In the context of a fasting active summer bear, while food may be withheld, water is available on demand.

Fibroblast: A stellate or spindle-shaped cell with cytoplasmic processes present in connective tissue, capable of forming collagen fibers.

Gas Chromatography(GC): A method of chromatography in which the substance to be separated into its components is diffused along with a carrier gas through a liquid or solid adsorbent for differential adsorption.

High Performance Liquid Chromatography (HPLC): Method of partitioning chromatography that employs high pressures to propel the solvent through a thin column resulting in a high resolution of complex mixture.

Intraperitoneally: Inside the abdominal cavity.

Latin Square Design: An experimental design which gives statistical meaning to data when using small numbers of experimental units (e.g. numbers of animals, samples, etc.). The number of treatments tested is always equal to the number of experimental units being used and each experimental unit receives all treatments over time.

Lyophilization: The creation of a stable preparation of a biological substance or isolate (blood serum, plasma, etc.), by rapid freezing and dehydration of the frozen product under high vacuum.

Lyophilize: Freeze dry.

Mass Spectrometry (MS): A procedure used to determine the masses of atoms or molecules in which a beam of charged particles is passed through an electric field that separates particles of different masses.

Metabolites: Any of various inorganic or organic compounds produced by metabolic pathways in the body such as urea, creatinine, amino acids, hydroxy acids, fatty acids, glucose, ions, etc.

Monocyte: Cells with a single nucleus derived from marrow monoblasts. They have deeply indented and irregularly shaped nuclei and bundled and scattered single filaments in the cytoplasm. Marrow monocytes are responsible for forming osteoclasts.

Ninhydrin: Agent used to develop color on TLC plates.

Nuclear Magnetic Resonance (NMR): The absorption of electromagnetic radiation of a specific frequency by an atomic nucleus that is placed in a strong magnetic field, used especially in spectroscopic studies of molecular structure.

Osteoblast: A cell from which bone develops.

Osteoclast: A large multinuclear cell that resorbs bony tissue in the process of osteoclasis.

Osteoid: Relating to or resembling bone ossiform; newly formed organic bone matrix prior to calcification.

Osteoporosis: Demineralization of bone; decrease in bone mass or structure.

Ovariectomy: Surgical removal of the ovaries.

Pellet by Centrifugation: Spin sample to force protein residues to bottom of test tube.

Phosphomolybdic Acid Detection: Method used to develop color on TLC plates.

Renal Failure: Inability of kidney to function properly; one aspect is failure to excrete the amount of urea formed by the body daily. This leads to a gradual elevation of urea which may result in uremia, a toxic condition, that requires dialysis or kidney transplantation for treatment.

Resolution Factor (R_f): The distance that the midpoint of the compound travels on a given plate divided by the distance the solvent travels on the plate.

Resorb: To dissolve and assimilate.

Silica Gel/Column Chromatography: Sandlike material is placed in a long glass tube which is wet with solvents and is used to separate the materials by retaining some components on the silica while other components pass through depending on the solvents used.

Sham: A subject is subjected to surgical procedure without removal of organs (ovaries) in order to duplicate the physical and mental impact of the surgical procedure on test animals.

Silica Plate: Glass plate or microscope slide coated or painted with sand-like material. Used to separate and detect substances.

Stirring Rod: Metal or glass rod used to stir mixtures (e.g. spoon in coffee).

Supernatant: Liquid fraction of a liquid solid mixture where the solid has settled to the bottom of its container (e.g. in water and sand, water is the supernatant).

Thin Layer Chromatography (TLC): Method used to separate chemical constituents which can then be identified by color or other properties upon development.

Transamination: A process involved in the metabolism of amino acids in which amino groups ($-NH_2$) are transferred from amino acids to certain keto acids yielding new keto and amino acids.

Triturate: Treat certain dry materials by dissolving part of them into solution leaving behind components that do not dissolve in said solution.

Ultrasonication: Using sound waves to remove particles from small places (e.g. used to clean jewelry).

BACKGROUND OF THE INVENTION

It is known that denning, fasting black bears, fasting polar bears, and pregnant female polar bears who den possess blood factors that can recycle harmful body waste products back into usable protein for building tissue, and that denning, fasting black bears can continue to build bone when the bear is immobile for months at a time. Upon isolating the substance which controls this phenomena in the bear, there is the possibility that the same can be used to prevent toxic buildups that endanger humans with kidney failure that now require the stressful, expensive treatments of dialysis and kidney transplant to sustain life. The isolate (BDI) also includes the possibility that it can prevent protein breakdown which leads to life threatening situations in humans suffering burns and trauma.

It is believed that such knowledge can lead to strategies to combat bone loss, which afflicts millions of middle aged and elderly people, especially post-menopausal women and astronauts in weightlessness of space. Loss of bone mass in space is one of the major problems that prevents long term space flights by humans.

Bears preparing to enter the denning phase go through a period of hyperphasia during which they eat enough food to store enough fat to last through the denning period. During denning, bears do not eat, do not drink, and do not urinate or defecate. Exiting the den after a four to five month period, the bears resume normal eating patterns. Knowledge and/or the isolate (BDI) may be useful in developing strategies and/or products for the treatment of eating disorders such as anorexia nervosa and bulimia.

Black bears in particular, during their three to five month denning, show a reduction in body temperature of at least 2 °C, remain alert and expend energy normally; yet they do not eat, drink, urinate, or defecate and exhibit no problems with waste building to toxic levels. Other mammals, including humans, can recycle some waste, but under similar conditions must quickly rid themselves of the rest of their waste or die.

It has been determined that bears in a non-denning state during summer months are induced to produce the isolate (BDI) after 20 days of fasting, even though they are

allowed to drink water. Under these circumstances, bears urinated and did not exhibit the tranquility associated with a denning bear.

Other mammals (including deep hibernators such as ground squirrels who continually awaken throughout hibernation and generate waste they must get rid of) break down protein mainly from muscle to supply energy and other essential nutrients for life. This process not only depletes body muscle, it also releases the toxic form of nitrogen as ammonia. Mammals, including humans, convert the ammonia to urea, which is much less toxic but must be eliminated in urine. During denning, black bears also produce urea, but close this loop and recycle the urea nitrogen back into protein. They produce no waste and maintain muscle mass while eliminating the need to urinate or defecate. The process is so efficient that normal urea concentration in blood decreases and body protein increases. The bear is the only animal known that fasts completely (no food or water) yet ends a 100 day or longer fast with a little more protein (lean tissue) than when it started. During the denning period, the bear steadily consumes body fat that had been stored during the pre-denning period.

This unique response extends to maintenance of bone mass. The bear shows no bone loss even when supine over more than 100 days. In contrast, deep hibernators lose bone and exhibit osteoporosis when hibernating. The bear does not develop osteoporosis and is able to maintain skeletal integrity despite the harsh conditions. Under similar stimuli, humans would suffer severe bone loss.

Taken in the context of the foregoing, it is a desirable forward goal in the treatment of human ailments to be able to isolate the bear derived isolate (BDI) which permits the foregoing phenomena in bears, and to translate it into meaningful metabolic and curative processes in the human.

These goals appear possible. For instance, a bile salt produced by the bear has been shown to improve liver function in humans with the fatal disease of primary biliary cirrhosis. In humans, this bile salt also reverses serious rejection reactions against bone

marrow transplants. Further, this bile salt, ursodeoxycholic acid, is the most effective dissolver of human gall stones. Thus, a isolate produced by bears has direct positive application to human disorders.

Important to the present invention is the skill of the technician practicing the invention in identifying when the true state of denning exists in the bear and when the denning bear accomplishes the unique management of wastes such that none accumulate.

Experiments and observations directed to studies in denning bears have been under way for more than 23 years. During that time, it has been established that the recycling of body wastes causes the blood ratio of urea to creatinine (U/C) both expressed in mg/dl to decrease from 20 or more (sometimes ranging as high as 70 after eating a high protein diet) to 10 or less - something impossible for any other mammal that is not drinking fluid. A U/C ratio of 10 or less due to a significant decrease in urea and a significant increase in creatinine indicates that recycling of urea is in progress. The low U/C ratio found throughout denning sometimes occurs in wild bears in the fall just before denning. At this point, wild bears have stored enough fat for denning. They stop eating and drinking; complete waste recycling has begun before they enter the den.

The bear continues to degrade amino acids and form urea. In turn, the urea molecule is quickly degraded by transferring nitrogen from it to substances such as pyruvic acid or alpha-ketoglutaric acid to reform amino acids. This latter process is called transamination. The substances necessary for transamination (pyruvic acid and alpha-ketoglutaric acid) are generated from glycerol which has been released from fat. The newly formed amino acids are then reincorporated into protein.

The overall process of urea recycling consists of two processes: 1) formation of urea from amino acids, and 2) reformation of amino acids from urea which are then reincorporated into protein. Since (2) is faster than (1), there is net formation of new protein. Based on our knowledge, no other fasting animal can accomplish this feat.

Some amino acids formed in the bear are: alanine, serine, ornithine, arginine, glycine, leucine, threonine, phenylalanine, and tyrosine. These amino acids are found in such proteins as albumin and fibrinogen.

Humans can recycle only about 25% of the urea they form. The bear, on the other hand, recycles urea back into protein a little faster than it makes it. Thus, its blood urea concentration diminishes even though it does not drink water or urinate. The amino acids that serve as vehicles for urea recycling are ordinarily found in all mammals, but not in the concentrations shown by bears when fasting. Therefore, it is assumed that they may become vehicles to be used with the bear derived isolate when duplicating the bear's unique recycling.

During denning, the kidney of the bear continually forms urine. Upon reaching the urinary bladder, the urine (which contains BDI) is completely absorbed by the wall of the bladder. Thus, in a highly concentrated form, BDI moves across the bladder wall into blood, circulates, and stimulates all tissues of the bear. When compared to the blood of fasting humans, blood of the denning bear differs in concentrations of some amino acids, bear ketones are much lower, and there is a difference in some other essential substances. While concentrations of many of these substances decrease during human fasting; they do not decrease in the bear. Therefore, exact profiles of these known metabolites may have to be added to BDI in order to duplicate the bear's unique recycling in humans.

Recycling urea, the waste product of protein breakdown, back into protein leads to maintenance of lean body mass.

To prevent bone loss, bone remodeling occurs normally while in the supine state. In the human, a supine state inhibits normal bone remodeling and leads to severe loss of calcium and bone.

All of these stages of prior art were possible only by developing the state of the art that permits bears to den in captivity and to design the definitive studies to explain the processes.

SUMMARY OF THE INVENTION

The present invention results from the discovery of the method and results from isolation of a material in bears, particularly black bears, called Bear Derived Isolate or BDI, that enables denning so that BDI can be used alone or identified with one substance or combination of substances either novel and unique or previously identified to help human beings and other mammals. All predictable results are based upon *in vivo* studies with guinea pigs, *in vivo* studies with rats, *in vitro* organ studies of calvarial mouse bone, and *in vitro* studies of prevention of proliferation of cells that resorb bone and stimulation of proliferation of cells that form bone using cell cultures of monocytes, osteoclasts, osteoblasts and fibroblasts. BDI is present in the serum (blood) of denning bears. BDI is also present in urine of denning bears. However, because the bear is an omnivore, fasting in summer is extremely rare. What has been discovered however, is that when the normally active black bear is fasted in the summer time, but water not withheld, over a period of two to three weeks it will develop in the urine the same BDI referred to with regard to denning black bears. Post-fast data showed that urea recycling was induced. This was evidenced by a low serum urea/creatinine ratio, a slight increase in total proteins, and a marked increase in beta-hydroxybutyric acid. Accordingly where the term BDI is used, it includes fasting bears from which food has been withheld but which are not in the traditional denning season. The same can be extrapolated for active polar bears. Because the U/C ratio of polar bears is near 10 or less when fasting, urea recycling is indicated.

In order to obtain the research material (BDI) blood (serum) and urine are collected from black bears during their denning period. Quantities of 100 ml may be drawn monthly from each bear or on a more frequent schedule as required. The urine and/or serum is then subjected to the isolation method as described herein.

As illustrated in Table 1, isolation of BDI requires precipitation of protein from winter urine or serum using methanol, centrifuging the sample and removing precipitated protein as pellets, and drying the BDI into a visible extract. Further, by the use of thin layer chromatography (TLC), countercurrent chromatography (CCC), preparative thin layer

chromatography, or column chromatography, at least two compounds, both in urine and blood, can be isolated in BDI.

Thus, the method of isolating these compounds permits predictable separation of BDI into Fractions. These Fractions are suitable for biologic testing. One component is an as-yet-unidentified compound. It is called the Miers-Nelson Component (MNC) after the researchers. The other component is beta-hydroxybutyrate (BHB).

BDI can be divided into three Fractions which are sufficiently purified to test for their biological activity in guinea pigs, rats, and bone culture assays. These Fractions are:

<u>Fraction I</u> = BDI-[BHB+MNC] (*Early fractions*),
<u>Fraction II</u> = BHB (*Middle fractions*), and
<u>Fraction III</u> = MNC (*Late fractions*).

OBJECTIVES OF THE INVENTION

It is a primary object of the present invention to isolate and evaluate BDI which is present in a denning bear or fasting bear.

A further object of the present invention is to permit the isolation of BDI in such quantities that BDI used alone, or in combination with other metabolites and carriers, may be administered orally or by injection to other animals or humans for various treatments.

Being on the cutting edge of a pioneer area of analysis, yet another object of the present invention is to produce BDI (which permits denning) in order to facilitate further research concerning various beneficial results that can be achieved regarding the kidney, liver, bone growth and remodeling, brain, and nitrogen cycles in the body.

Yet another object of the present invention, and an important one, is to produce BDI in a form which, upon further analysis, will permit synthesis of BDI in larger volumes and at significantly reduced expenditures.

Further objects and advantages of the present invention will become apparent as the following description proceeds, taken in conjunction with the accompanying data.

Following is a Table illustrating the process for the isolation of BDI and two compounds found in it.

TABLE 1

Chemical Process for Isolation of BDI

and Two Compounds Found In It

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Research Procedure for Isolating BDI and Its Fractions

STEP	SAMPLE	PROCESS	YIELDS
One	Urine (50 ml)	1. MeOH Deproteinization 2. n-BuOH Trituration	Dry Sample (BDI)
Two	Dry BDI (3.5 g)	CCC (n-BuOH:AcOH:H_2O) 20:1:20	Dry Sample
Three	Dry sample (2 mg)	CCC (n-BuOH:AcOH:H_2O) 20:1:20	Fractions: A. Fraction I **BDI - [BHB+MNC]** Early CCC Fractions B. Fraction II **BHB** Middle CCC Fractions C. Fraction III **MNC** Late CCC Fractions

DESCRIPTION OF PREFERRED EMBODIMENT

THE DENNING PROCESS OF BEARS

The denning process of bears has been defined in the statement of Background of the Invention above. In order to obtain the bear derived isolate successfully, denning bears

must be available quickly and throughout the denning period as is the case at The Carle Foundation Bear Research Station, Champaign County, Illinois. At this facility, after food intake decreases in October or November, food is removed, inducing the bear to enter the denning state. At all times where reference is made to the bears which were used to produce BDI, such bears were the well known North American Black Bears (Ursus americanus).

Thereafter, blood and urine samples are taken from the bears. This continues until March when the bear leaves its den and has access to food and water. At first (for approximately two to three weeks), the bears slowly begin to eat after they emerge from their dens in the spring. Food intake reaches normal levels, and weight gain continues until early June in preparation for mating. By mid June the bears have normalized their body stores of fat that were diminished during denning and will continue to eat throughout the summer to maintain body weight. Slight increases in body weight throughout the summer can be attributed to continued growth. In late August, in preparation for the subsequent denning season, the bear increases its food intake from 5,000 to 8,000 Calories/day to 20,000 Calories/day. The bear eats almost to a calorie the quantity of food required to store enough fat to support energy requirements of denning, fetal support, and lactation. For a 400 pound bear, energy expenditure during denning is about 4,000 Calories/day.

Bears that have been fasted for a period of not less than 21 days during the summer or non-denning period, whose urine, when subjected to isolation methods, yielded a material (BDI) which produced bone remodeling effects and urea creatinine ratios comparable to that of the material (BDI) taken from a denning bear. The experiment related to 14 bears which were given free access to drinking water, but food was withheld for 21 days. The group was fasted during the month of July, a recognized non-denning period for bears. This was in an attempt to determine whether fasting is the controlling factor in the production of BDI.

Defecation stopped after approximately 2 - 3 days in the fasting bears, but occasionally bile stain material passed per rectum in some of the bears. With free access to water, the

bears drank enough to stimulate urination. (Excess water was required because the only mechanism bears have to regulate body temperature is through evaporation via the respiratory tract. In summer, ambient temperature is much higher than experienced by denning bears, thus there is a need for increased evaporative water loss. This, in turn, stimulated drinking, which exceeded the bears' requirements for body temperature control and thus stimulated urination.) Even though the fasted bears drank water, thirteen of fourteen bears showed an increase in serum creatinine. Eleven of fourteen bears showed a reduction in serum urea, which resulted in a significant reduction in the U/C ratio. Five animals demonstrated values previously known to be associated only with denning bears (Table 2).

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TABLE 2 - SUMMER BEAR FASTING EXPERIMENT: 7/13/94 to 8/2/94

DATE	7/13/94	8/2/94	7/13/94 to 8/2/94	7/13/94	8/2/94	7/13/94	8/2/94	7/13/94	8/2/94
BEAR	PRE-FAST WEIGHT (lbs.)	POST-FAST WEIGHT (lbs.)	WEIGHT LOSS (lbs.)	PRE-FAST UREA (mg/dl)	POST-FAST UREA (mg/dl)	PRE-FAST CREATININE (mg/dl)	POST-FAST CREATININE (mg/dl)	PRE-FAST U/C RATIO	POST-FAST U/C RATIO
1-524	256	214	- 42	22.39	21.89	1.4	2.1	15.99	10.42
2-523	186	150	- 36	29.61	36.70	1.4	2.2	21.15	16.68
3-519	358	298	- 60	31.70	27.47	1.7	2.6	18.65	10.56
4-521	226	186	- 40	32.60	41.85	1.7	2.1	19.18	19.93
5-522	350	302	- 48	30.90	18.24	1.8	2.1	17.17	8.69
6-520	298	248	- 50	32.20	30.90	2.1	2.4	15.33	12.88
♀ 7-513	210	178	- 32	30.70	26.61	1.5	2.1	20.47	12.67
♀ 8-514	216	190	- 26	45.50	27.47	1.7	2.6	26.76	10.56
9-515	306	260	- 46	37.98	30.26	2.2	2.3	17.26	13.16
♀ 10-516	162	140	- 22	33.00	31.55	1.6	2.2	20.63	14.34
11-518	304	262	- 42	19.74	36.48	1.6	2.6	12.34	14.30
12-517	306	260	- 46	44.40	24.46	2.3	2.0	19.30	12.23
U.P.	412	356	- 56	49.35	24.46	2.4	2.7	20.56	9.06
Caruso	388	328	- 60	42.30	31.76	1.9	2.4	22.26	13.23
MEANS	284 ± 77	241 ± 67*	-35 ± 15	34.46 ± 8.5	29.29 ± 6.3	1.8 ± 0.3	2.3 ± 0.2*	19.08 ± 3.47	12.75 ± 3.0*

**Indicates a significant difference between the Pre-fasting and Post-fasting values using a paired t test, $p<0.01$.*

SUMMARY

Active bears eating normally were fasted 21 days. After fasting:

1. 11 out of 14 bears showed a decrease in the concentration of serum urea.
2. 13 out of 14 bears showed an increase in serum creatinine.
3. 12 out of 14 bears showed a decrease in the U/C ratio with 5 bears showing values ≤10.

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Data collected from fasted summer bears (after they had been eating normally during the non-denning period) were compared with data collected from fasted winter bears. Although bears usually den (and don't eat) during the winter, these bears had been eating prior to entering the Carle Bear Research Facility. The data collected from fasted summer bears were similar to data collected from the same bears after a three week winter fast (Table 3).

H.0190

TABLE 3 - WINTER BEAR FASTING EXPERIMENT: 2/14/94 to 3/7/94

DATE	2/14/94	3/7/94	2/14/94 to 3/7/94	2/14/94	3/7/94	2/14/94	3/7/94	2/14/94	3/7/94
BEAR	PRE-FAST WEIGHT (lbs.)	POST-FAST WEIGHT (lbs.)	WEIGHT LOSS (lbs.)	PRE-FAST UREA (mg/dl)	POST-FAST UREA (mg/dl)	PRE-FAST CREATININE (mg/dl)	POST-FAST CREATININE (mg/dl)	PRE-FAST U/C RATIO	POST-FAST U/C RATIO
1-524	280	230	- 50	15.02	10.73	1.5	2.0	10.01	5.37
2-523	192	156	- 36	17.17	19.31	1.6	2.2	10.73	8.78
3-519	384	332	- 52	30.04	15.02	2.1	2.7	14.31	5.56
4-521	288	238	- 50	32.18	12.88	1.7	2.1	18.90	6.13
5-522	380	324	- 56	19.31	15.02	1.7	2.3	11.36	6.53
6-520	282	244	- 38	23.61	10.73	2.2	2.5	10.73	4.30
♀ 7-513	228	206	- 22	27.90	10.73	1.8	2.1	15.50	5.11
♀ 8-514	222	198	- 24	36.48	21.46	2.2	2.4	16.58	8.94
9-515	328	282	- 46	32.19	32.19	2.2	2.3	14.63	14.0
♀ 10-516	184	152	- 32	27.90	27.90	1.6	1.8	17.44	15.50
11-518	318	286	- 32	32.19	21.46	2.4	2.9	13.41	7.40
12-517	354	316	- 38	17.17	10.73	1.5	2.0	11.44	5.36
* U.P.	380	374	- 06	10.73	10.73	3.3	3.4	3.25	3.16
* Caruso	436	426	- 10	6.40	6.44	3.2	3.2	2.01	2.01
MEANS	286 ± 69	247 ± 62	-43 ± 15	25.88 ± 7.19	17.30 ± 7.21**	1.9 ± 0.3	2.3 ± 0.3**	13.72 ± 2.92	7.73 ± 3.57**

* *Bear was already denning.*
** *Indicates a significant difference between the Pre-fasting and Post-fasting values using a paired t test, $p<0.01$.*

SUMMARY

Of the bears who were not previously denning (ie. had access to food during the winter), after fasting:

1. 9 out of 12 bears showed a decrease in the concentration of serum urea.
2. 12 out of 12 bears showed an increase in serum creatinine.
3. 12 out of 12 bears showed a decrease in the U/C ratio with 10 bears showing values ≤10.

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It was concluded that after both the summer fast and the winter fast, the bears were in the urea recycling mode previously only characterized during denning.

The prefasted BDI from summer urine tested in bone cultures was from catheterized specimens while the post BDI from urine was collected without anesthesia from the specially adapted metabolic cages. As described later, BDI from the latter sample significantly increased osteoblast activity.

CHEMISTRY OF THE INVENTION

Introduction

The presentation to follow is divided into two parts. The first deals with the chemical process of isolation and characterization of BDI and two compounds characteristic of the winter denning bears (BHB and MNC) found in BDI. The second part describes the biologic activity of BDI and three of its component Fractions. The chemical isolation of BDI using chromatography makes it possible to divide purified BDI. Countercurrent chromatography yields 50 fractions in successive order: 1 - 50. The first group of CCC fractions (1 - 17) does not contain either BHB or MNC. The second group of CCC fractions (18 - 22) contains BHB. The third group of CCC fractions (23 - 50) contains MNC, found mainly in fractions 25 - 29. The CCC machine is then washed out to collect anything left in it. The third division also includes the wash; nothing is discarded. CCC fractions are grouped for further studies and labeled Fraction I, Fraction II, and Fraction III.

The specific fractions related to CCC samples may vary slightly. For instance, BHB may elute in fractions 19 - 23, and MNC in fractions 24 - 29. However, all CCC samples at division points are tested by thin layer chromatography so that no BHB appears in either Fraction I or Fraction III and so that no MNC appears in Fraction II.

Therefore, through the use of CCC, two characteristic components can be isolated. They also serve as logical points for division of BDI into three Fractions in order to test biologic activity: Fraction I (BDI-[BHB+MNC]), Fraction II (contains BHB), and

Fraction III (contains MNC). When separated by CCC, these Fractions are known to contain amino acids, ammonia, urea, creatinine, creatine, and other animal products.

Identification of Bear Derived Isolate (BDI) Derived from Urine

A 50 ml aliquot of bear urine is deproteinated by diluting with methanol (1:1 v/v) and allowing proteins to precipitate out overnight at -20°C. The proteins are then pelleted by centrifugation (20 minutes @ 2500 r.p.m., 10°C) and the supernatant is extracted. To completely dry the supernatant extract, nitrogen gas is used to remove methanol. Samples are then frozen (-80°C) and lyophilized. Once dry, samples are weighed using Mettler Analytical Balance AE163. Fifty milliliters of winter bear urine yields approximately 3.5 g of dry residue known as BDI. For observation of the effects of BDI, the dry deproteinated sample (BDI) is reconstituted with 2 or more ml of saline. This solution can then be used for guinea pig and bone culture studies.

Isolation and Characterization of the Miers-Nelson Component (MNC)

Step I: Verification of MNC Presence In BDI

BDI containing MNC is prepared as before and dried to a residue using nitrogen gas or lyophilization. The BDI is then:

Dissolved in 100 - 500 μl of methanol depending on sample weight.

To test for presence of MNC in number (1) above, approximately 4 - 6 μl is applied to normal phase TLC plates (EM Science, P.O. Box 70, 480 Democrat Road, Gibbstown, NJ 08027-1296 Silica Gel 60 F_{254}, 0.25 mm) in successive μl applications.

The silica plate is then developed in a 4:1:1 1-butanol:acetic acid:water solvent system contained in a TLC chamber. Once developed, the plate is removed, dried by heat gun, and finally detected by ninhydrin spray (0.3% w/v in 1-butanol).

Location of MNC is detected with vigorous heating by heat gun and/or hot plate until edges of the TLC plate are charred.

At this point in isolation, MNC is visualized as a pink spot at $R_f = 0.74 - 0.80$.

Step II: Purification of MNC

Approximately 1.75 g of BDI containing MNC is then prepared for the next purification step involving countercurrent chromatography. This procedure utilizes a bi-phasic solvent system of 1-butanol:acetic acid:water (20:1:20) and a Countercurrent Chromatography System with #10 semi-preparative coil (P.C. Inc.).

Two liters of the bi-phasic solvent described above is prepared at least one day prior to using CCC.

This butanol-acetic acid-water solvent system is mixed by shaking and allowed to settle 2 to 4 hours before separation of the organic and aqueous bilayers.

Two liters of solvent yields approximately 1200 ml of the organic stationary phase (primarily composed of butanol) and approximately 800 ml of the aqueous mobile phase (primarily composed of water).

The dried sample of BDI that has been prepared prior to the aqueous/organic solvent system still contains MNC. This sample is reconstituted in 5 ml of the solvent system (2 ml stationary phase:3 ml mobile phase) and loaded on to a 10 ml injection loop interfaced to the CCC.

The CCC coil is first loaded with 385 ml of stationary (organic) phase.

Using the mobile (aqueous) phase, the triturate is injected onto the coil for separation.

The coil is rotated at approximately 800 r.p.m., flow rate = 4 ml/min (LDC Analytical Mini Pump). Five minute samples are collected (Gilson Microfraction Collector #203).

Fifty (20 ml) samples are collected and the coil is washed with methanol:water (1:1 by volume).

All samples are then frozen (-80°C) and lyophilized (freeze dried).

Once dry, the 50 samples are analyzed by TLC/ninhydrin to determine which samples contain MNC.

MNC elutes in samples 25 - 29 (approximately 520 - 580 ml post coil).

Next, those usable, isolated MNC samples are combined with each other for further purification. Sample weight at this stage of purification has been reduced from 1.75 g to 1 - 2 mg. At this point, samples containing concentrated MNC also contain biological salts and significantly reduced concentrations of other impurities as detected by TLC/ninhydrin, UV, iodine vapor, and phosphomolybdic acid.

Then, samples containing MNC, the remainder of the CCC samples, and the wash of the CCC (fractions 22 through 50 plus wash) are recombined and passed through CCC a second time under the exact conditions described above.

Step III: Harvesting MNC: Preparative Thin Layer Chromatography

Final purification of Fraction III (MNC) entails the use of preparative thin layer chromatography.

The dried combined samples of MNC from the second countercurrent chromatography run are the sources of samples to be applied across an 8 x 12 cm silica thin layer plate. MNC is first reconstituted in 100 μl of methanol and then applied in ten 1 microliter (μl) spots across the plate.

Application of MNC in solution (to the TLC plate) is then repeated 10 times.

In order to achieve the best resolution, between each application the μl spots are allowed to air dry. When finished, each spot on the plate will contain 10 microliters (μl) of MNC in solution forming a band across the TLC plate.

The plate is then resolved in 4:1:1 BuOH:AcOH:H_2O. Once the solvent rises to 80% - 90% of the TLC plate, the plate is removed from the solvent and dried by heat gun.

Without developing the plate, the MNC band is removed by scraping the silica from the plate at the R_f region of 0.74 - 0.80.

The silica is then wetted in approximately 1 - 2 ml of 1-butanol with vigorous vortex mixing.

The 1-butanol and silica mixture is then centrifuged for 20 minutes at 2500 r.p.m. This allows the silica to pellet to the bottom of the tube.

The MNC containing butanol supernatant is then removed and dried down under nitrogen gas.

At this step in purification, the 1 - 2 mg sample has been reduced to 100 - 200 μg of MNC and is separated from salts and other impurities as detected by TLC/UV, ninhydrin, and iodine vapor. A lipid contaminant is apparent under phosphomolybdic acid development at the solvent front of normal phase TLC plates at this point. However, MNC remains the only significantly concentrated material present as detected by TLC/ninhydrin, UV, iodine vapor, and phosphomolybdic acid detection.

Properties of MNC

The harvested MNC has the following properties:

1. It is soluble in water, methanol, and 1-butanol.
2. It is insoluble in less polar organic solvents such as chloroform, toluene, and hexane.

3. It is stable when stored frozen at -20°C to -85°C for at least eight years.
4. It is stable at room temperature (20°C - 22°C) for at least four days.
5. It is heat resistant to 65°C.
6. It is slightly UV active by detection of TLC and UV spectroscopy at 280 and 320 nm wavelengths.
7. It is ninhydrin positive only with extended heating as previously described.
8. It can be identified as pink in color at R_f 0.77 - 0.80 when purified on normal phase silica TLC plates, sprayed with ninhydrin and heated.
9. It can be detected using iodine vapor development of normal phase silica TLC plates.
10. To date, no tested substances in blood and urine of mammals show characteristics similar to the ninhydrin reaction at R_f range of 0.77 - 0.80 on the thin layer chromatography used in isolation.
11. Recommended storage of the harvested MNC is to freeze it in a light resistant container under nitrogen gas.

Isolation and Characterization of Beta-hydroxybutyric Acid (BHB)

Preparative Thin Layer Chromatography

The verification, purification, and harvesting of BHB is similar to MNC, except that CCC samples 18 - 22 are used to elute BHB. Further, BHB is extracted using the same method of preparative thin layer chromatography except that the silica is scraped from the plate at the R_f region of 0.82 to 0.92.

Flash Column Chromatography

An alternative method of harvesting BHB called Flash Column Chromatography can be used. When this method is used, BHB samples obtained from CCC purification are combined and dried.

The combined samples are reconstituted in 250 μl of 1-butanol. Mixing and ultrasonication are used to induce the sample into a homogeneous solution.

Once the samples are completely solubilized in the 250 μl of butanol, 250 μl of acetone is added to the solution. The resultant 500 μl sample is ready for subsequent purification by silica gel flash column chromatography.

A 15 x 230 mm silica gel (0.040 - 0.063 mm particle, 230 - 400 mesh) column is packed and wetted with five column volumes of acetone:1-butanol (99:1). This ratio significantly contributes to purity and yield.

The 500 μl samples, in 1-butanol:acetone (1:1), are applied to the column and are desirably eluted isocratically with acetone:1-butanol (99:1) under nitrogen gas pressure (5psi) at a rate of approximately 2 in/min. Fifty (1 ml) samples are collected in approximately 20 - 30 minutes.

Since acetone is the primary solvent, all collected samples are dried by nitrogen gas or allowed to air dry, and then visualized by TLC/ninhydrin. BHB elutes off the column in samples 19 - 21 with good reproductibility and resolution given the method employed.

SUMMARY OF PREPARATION OF PRE-FASTED AND FASTED URINE

The bears were fasted overnight before the day of the experiment. They were allowed unlimited access to water. On the day of the experiment bears were anesthetized with Telazol, i.m. 4-5 mg/kg body weight. Baseline blood and urine (catheterized) were taken as pre-fast controls. Catheterized urine was only collected from three of the bears, numbers 4/521; 9/515; and 12/517. The urine was pooled and treated with an equal amount of methanol (165 ml). After sitting overnight at 0°C, the urine was centrifuged at 1650 gravity x 15 minutes. The supernatant was removed and the precipitate discarded.

Next, the supernatant was placed under a nitrogen stream until most of the methanol had been removed. The sample was then frozen at -80°C. After freezing, the sample was placed on the lyophilizer. YH 11-9-1 (BDI-U) was then used either for use in the bone culture or further purification by countercurrent chromatography (CCC).

Twenty-one days later, the bears were again anesthetized to collect serum and urine in the same fashion as the pre-fasted controls. Prior to this, beginning July 28, 1994 until August 2, 1994, urine was also collected from beneath the cages. All male urine was pooled and female urine was pooled. Catheterized urine was collected from bears and kept separately and treated with an equal volume of methanol after aliquots were removed for urea and creatinine analysis: 6/520 (4ml, YH 11-13-2), 9/515 (119ml, YH 11-13-3), and 11/518 (17ml, YH 11-13-4). Also collected from two of the older bears was 125 ml from Caruso (YH 11-13-5), and 6.5ml from UP (YH 11-13-6).

The samples were purified by countercurrent chromatography in the following manner. The dried, deproteinated serum (BDI, 0.5 to 1.0 g), was reconstituted in three to four ml of a lower phase 1-butanol:acetic acid:water (20:1:20) mixture. Ten fractions were collected in one run according to the standardized protocol (as attached). The samples were then lyophilized, reconstituted in methanol for transfer to pre-weighed vials, and then dried down under nitrogen for weight determination. At this point, samples were then evaluated for further bone cultures, lc/ms or further purification by HPLC. The cultures which were run with urine produced enhanced bone remodeling both of the osteoblastic enhancement and the osteoclastic diminution.

Formation of the Organic Bone Matrix - Osteoid

Both osteoblasts and fibroblasts are involved with formation of osteoid, the matrix of bone. BDI directly stimulates proliferation of osteoblasts, increasing their numbers by 129%. In a similar fashion, BDI directly stimulates proliferation of fibroblasts by 205%. BDI was tested in fibroblast cultures of NIH-3T3 cells. The concentration of BDI that achieved maximum results was 10 mg/ml, the same concentration that achieved maximum results in the osteoblast cultures of MC-3T3 cells. Thus, BDI coordinates the final stage of bone remodeling by furnishing a place to put new bone. BDI induces a similar significant proliferation of fibroblasts (the cells that form matrix or osteoid), the supporting structure of bone, as BDI induced in osteoblasts. Furthermore, the proliferation response of fibroblasts to BDI is similar to proliferation and the bone production response of osteoblasts to BDI.

Thus, BDI orchestrates bone remodeling in a remarkable fashion. In order to form bone while under the combined stresses of not eating or drinking, remaining non-weight bearing, and in the absence of sex steroid production, the bear makes enough bone to avoid osteoporosis. To do this, the bear must shut down bone resorption, stimulate bone formation, and prepare a place to put the newly formed bone. The bear accomplishes this by inhibiting bone resorption while simultaneously stimulating bone formation.

Vitamin D and Bone Integrity In the Denning Bear

During denning, unopposed action by the active form of vitamin D, 1,25-dihydroxyvitamin D_3 would produce bone loss, high blood calcium, and death. Ordinarily, 1,25-dihydroxyvitamin D_3 stimulates the gut to absorb calcium to replace calcium lost in urine. If insufficient calcium is in food, 1,25-dihydroxyvitamin D_3 stimulates bone to release calcium (bone resorption) to keep blood levels of calcium constant.

Since the denning bear is fasting and not urinating, unopposed action of 1,25-dihydroxyvitamin D_3 on bone would constantly stimulate bone to release calcium, causing blood calcium to rise to high enough levels to cause cardiac standstill and death. To prevent this occurrence, the bear reduces production of 1,25-dihydroxyvitamin D_3 while increasing production of another form of vitamin D - 24,25-dihydroxyvitamin D_3. Considered by most a metabolite of vitamin D that has no metabolic action and normally excreted from the body, the 24,25 form actually stimulates bone deposition. The effect of increasing production of 24,25-dihydroxyvitamin D_3 while decreasing production of 1,25-dihydroxyvitamin D_3 has a favorable effect. The ratio of 24,25 to 1,25 changes from 186 to 300 in captive denning bears (who have ample vitamin D in their summertime food rations) and from 16 to 89 in wild, denning bears.

The large increase in the ratio of 24,25 to 1,25 (61% in captive and 456% in wild bears) serves two purposes:

1. The ability of 1,25-dihydroxyvitamin D_3 to release calcium from bone is reduced, and

2. The increase in 24,25-dihydroxyvitamin D_3 is enough to recycle calcium that continues to be lost from bone back into bone. The ideal regulation of vitamin D metabolites to prevent high blood calcium only works if the bear can prevent bone loss. We have found that although the bears exists in a state similar to a post-menopausal woman, the bear makes bone normally, protects its skeleton from osteoporosis, and prevents high blood calcium and death.

Female rats grow normally when receiving daily injections of BDI at a concentration similar to that which enters the blood stream each day from the urinary bladder of a denning bear. No untoward, observable signs or symptoms indicative of adverse reactions to BDI were observed in these rats.

Fasting Summer Bear Conclusions

The fasting summer bear exhibits substantially the same decrease in urea to creatinine ratio as the denning winter bear. Moreover, it exhibits essentially the same bone remodeling enhancement as the denning winter bear. Accordingly, the beneficial aspects of the bear isolate as it relates to renal disorders and osteoporosis appear to be equally as potent with the summer fasting bear as with the winter denning bear.

BIOLOGY OF THE INVENTION

EVALUATION OF BDI AND ITS FRACTIONS

***IN VIVO* STUDIES: INDUCING DENNING BEAR BEHAVIOR IN GUINEA PIGS and *IN VITRO* STUDIES: STIMULATION OF BONE REMODELING**

In vivo Studies

Introduction

The first study was exploratory. It evaluated BDI that had been isolated from winter urine. The second study determined the effects on vital signs of the guinea pig of a lyophilized sample of winter urine and of the precipitate isolated from the urine during deproteination. The third study used a Latin Square Design. It was an in-depth investigation of BDI and three of its isolated Fractions. The fourth study compared

fifth study compared BDI derived from winter, denning bears with serum from active, eating bears. As described under "Chemistry of the Invention", serum from winter, denning bears (BDI) and serum from active, eating bears were deproteinized with methanol, the proteins were pelleted by centrifugation, and the supernatants were removed and lyophilized. The dry samples were then reconstituted in 2 ml of saline.

Study One: Exploratory Study Comparing Effects of Summer and Winter Urine on Body Temperature, Heart Rates, and Tranquility in Guinea Pigs

Methods

Urine from denning and non-denning bears was processed in similar fashion. Guinea pigs received BDI in the same relative concentration as it appears in the denning bear. Thus, the predicted concentration in the blood of the guinea pig was about equal to the predicated concentration of BDI in the blood of the denning bear. Blood volume was estimated as five percent of body weight. 50 ml of urine was deproteinated, lyophilized, and reconstituted in 2 ml of sterile saline as described above. A 2 ml sample was delivered by intraperitoneal injection into each animal.

Results

Five minutes post injection, the animals receiving BDI presented signs of tranquility, reduced heart rate [from approximately 256 to 96 beats per minute (BPM)], and reduced body temperature (from approximately 38°C to 35°C or 100.4°F to 95°F). The tranquil effects lasted approximately 50 minutes. The tranquil effects were evidenced by the fact that animals could be held on their backs without signs of struggle and that the guinea pigs were alert to their surroundings, but were simultaneously very calm and indifferent to external stimuli such as sudden loud noises. Body temperatures did not return to normal for up to 15 to 20 hours post injection.

Guinea pigs receiving urine from non-denning bears that had been processed in a manner similar to the processing of BDI showed no decreases in body temperature or heart rate. They did not develop a tranquil state.

Conclusion

These data indicate that BDI induces responses of the denning bear in the guinea pig.

Study Two: Comparing Effects of Whole Urine and Precipitate On Heart Rates and Body Temperature In Guinea Pigs

Methods

Four guinea pigs were injected with varying doses of lyophilized samples of winter bear urine or the precipitate resulting from deproteination of winter bear urine. Rectal body temperature was measured and an electrocardiogram (ECG) was taken every 15 minutes after time of injection. The material to be injected was prepared in the following manner.

Whole bear winter urine was aliquoted out into 20 ml, 40 ml, and two 50 ml samples.

The 20, 40, and one of the 50 ml samples were lyophilized and placed in the freezer until the day of the experiment.

The second 50 ml sample was treated with an equal volume of methanol, vortexed, and allowed to set in the freezer overnight.

The next day, the methanol treated urine was centrifuged and the supernatant removed.

The remaining precipitate was dried under a nitrogen stream and then frozen until the day of the experiment.

On the day of the experiment, each of the four samples were reconstituted into 2 ml of bacteriostatic 0.9% saline for injection. After a control ECG and rectal body temperature (°F) were taken, each guinea pig was injected intraperitoneally. ECG recordings and rectal temperatures were then taken every 15 minutes for up to 90 minutes.

Results (Table 4 and Table 5)

The guinea pig receiving the protein precipitate (0.0148 g) had an average increase in heart rate of 18 bpm during the 90 minute observation period. The maximum change in heart rate was +28 bpm and occurred 15 minutes after injection. Rectal temperature changes ranged from -1.2°F to +0.7°F.

The guinea pig that received the lyophilizate from 20 ml of urine (0.5384 g) exhibited an average decrease in heart rate of 49 bpm with the lowest heart rate measured at 15 minutes after injection. Rectal temperature decreased an average of 2.1°F over the 90 minutes.

In the animal that received the lyophilizate from 40 ml of urine (1.2164 g), heart rate decreased by an average of 60 bpm within 15 minutes after injection. However, heart rate returned to normal more rapidly in this particular animal than in the guinea pig that received only 20 ml of the lyophilized urine. Therefore, the average change in heart rate for this animal was only -4 bpm. In contrast, rectal temperature decreased by 5.5°F and remained lowered even at 90 minutes.

The guinea pig that received the highest dose of the lyophilizate from 50 ml of urine exhibited a maximum decrease in heart rate (-154 bpm) at 15 minutes. Rectal temperature decreased by 7.3°F and was still 6° lower than control 90 minutes after injection.

All animals survived.

TABLE 4

GUINEA PIG STUDY: WHOLE URINE AND PRECIPITATE MEAN CHANGES IN HEART RATES (BPM) (Treated Rates - Control Rates)				
Post Injection Time	Protein Precipitate	20 ml	40 ml	50 ml
15 minutes	+ 28	- 83	- 60	-154
30 minutes	+ 18	- 34	+ 19	-129
50 minutes	+ 17	- 50	+ 15	-103
75 minutes	+ 20	- 43	+ 6	-135
90 minutes	+ 9	- 37	0	-120
Mean of Means	+18.4	- 49.4	- 4.0	-128.2

TABLE 5

GUINEA PIG STUDY: WHOLE URINE AND PRECIPITATE CHANGES IN BODY TEMPERATURE (°F) (Treatment Temperature - Control Temperature)				
Post Injection Time	Protein Precipitate	20 ml	40 ml	50 ml
15 minutes	-	- 0.5	- 0.3	- 4.3
30 minutes	0.0	- 2.6	- 2.8	- 5.0
45 minutes	+ 0.7	- 4.4	- 5.5	- 7.3
60 minutes	- 1.2	- 3.2	- 5.3	- 6.8
90 minutes	- 0.7	- 0.0	- 5.1	- 6.8
Mean	- 0.3	- 2.14	- 3.8	- 6.0

<u>Summary</u>

Fifty ml of winter bear urine that had been lyophilized and reconstituted in 2 ml of normal saline caused a 45% decrease in heart rate within 15 minutes of injection.

Fifty ml of winter bear urine that had been lyophilized and reconstituted in 2 ml of normal saline caused a decrease in rectal temperature that was maximal at 45 minutes post injection.

Both effects were sustained throughout the 90 minute observation period.

In the guinea pigs that received the lower doses of the lyophilizate from bear urine, heart rate and rectal temperature still decreased with maximal effects measured at 15 minutes for heart rate and 45 minutes for temperature.

The magnitude of the effects produced by 20 ml and 40 ml of urine were smaller when compared to 50 ml of urine.

The animal that received the precipitate intraperitoneally exhibited an increase in heart rate rather than a decrease with little or no change in rectal body temperature.

Conclusions

The lyophilized winter bear urine injected intraperitoneally into conscious guinea pigs produced a decrease in heart rate and rectal body temperature similar to changes previously noted with BDI. The precipitate from the same volume of urine did not produce the same effects; it did not decrease heart rate and had little or no effect on rectal body temperature.

Study Three: Latin Square Designed Studies - The Effect of BDI In A Non-Hibernating Animal, The Guinea Pig

Introduction

This study was designed to test the effects of BDI and its Fractions in guinea pigs. To ensure unbiased observations, the study was blinded so that the researchers did not know which animal was injected with BDI, with Fraction I, with Fraction II, with Fraction III, or with saline. The Latin Square Design permitted use of animals as their own controls. Thus, in each animal, changes in heart rate and temperature after experimental injections

were compared to the guinea pig's own recorded normal heart rate and temperature prior to each injection. In addition, all animals received a control injection of sterile saline during the five week experimental period in an effort to measure the physiologic response in each animal to the pain of the injection itself. Food and water intake, urine output, and urea and creatinine excretion in urine were measured daily for four days after each injection. Therefore, each animal is used as its own control, and each sample injection can be compared to a saline control injection in all animals.

Methods

Heart rates were intermittently monitored by electrocardiograms. Rectal temperatures were intermittently monitored via inserted thermistors calibrated to National Bureau of Standard requirements. Recordings were made every 15 to 30 minutes throughout the two to three hour study. A video camera was used to record behavioral activity in each animal throughout the study. Research observers were asked to comment on each animals' tranquility by observing animal handling and animal reaction when exposed to a loud snapping noise. Thereafter, the animals were housed in a metabolic cage throughout the five-week experiment in order to measure food and water intake and urine output. Urine urea and creatinine concentrations were measured. Effects of the following fractions were compared with BDI, with the saline control, and with each other: Fraction I, representing BDI-[BHB+MNC]; Fraction II, representing BHB; and Fraction III, containing MNC.

Design

Fractions were obtained by combining appropriate samples from the second CCC run. They were lyophilized as those for BDI. Thereafter, they were reconstituted in a saline solution.

After collecting Fraction I, Fraction II, and Fraction III, the study was blinded so that the researchers did not know which animal was injected with Fraction I, with Fraction II, with Fraction III, with saline, or with BDI. Animals were used as their own controls in a Latin Square Design. Heart rates were intermittently monitored by electrocardiograms. Rectal

temperatures were intermittently monitored via inserted thermistors. Results were recorded every 15 to 30 minutes throughout the two to three hour study. A video camera was used to record behavioral activity in each animal throughout the study.

To measure effects on body temperature (°C), heart rates (BPM), and tranquility from each injection on the five guinea pigs, the data were grouped into the following time categories: Zero minutes (pre-injection control), 15 - 25 minutes, 30 - 40 minutes, 41 - 59 minutes, 60 - 74 minutes, and 75 - 95 minutes (post injection). Each animal was used as its own control. Treatment means were reported as the difference of each injection effect from the zero minutes (control) result. Therefore, positive or negative treatment mean values indicate an increase or decrease in the effect measured. A similar approach was used for daily determinations of food and water intake and urine excretion of urea and creatinine.

<u>Results</u>

<u>Body Temperature (Table 6)</u>

Beginning at 30 minutes and extending through to the end of the study, BDI produced a significant reduction in body temperature. The overall mean of temperature reduction was seven fold greater than that experienced by the animal when it received saline as a control measure.

Effects of Fraction I, Fraction II, and Fraction III were not different from control observations throughout the study.

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TABLE 6

GUINEA PIG STUDY: 5 x 5 LATIN SQUARE MEAN CHANGES IN BODY TEMPERATURE (°C) (Treatment Temperature - Control Temperature)						
Post Injection Time	I	II	III	BDI	C	$p<0.05$
15 to 25 minutes	0.33	0.41	0.35	0.34	0.01	N.S.
30 to 40 minutes	0.10	0.34	0.19	-0.31	-0.31	N.S.
41 to 59 minutes	0.03	0.22	0.17	-0.84	-0.24	N.S.
60 to 74 minutes	-0.15	0.21	0.10	-1.14	0.01	*
75 to 95 minutes	-0.42	0.12	0.38	-1.54	-0.15	*
Mean of Means	-0.02	0.26	0.24	-0.70	-0.10	-

I = BDI - (BHB + MNC)
II = BHB
III = MNC through Wash
C = Saline Control

* *Treatments are significantly different at p<0.05*

BDI produced a significant reduction in heart rate. Animals receiving Fraction I showed a significant heart rate reduction of approximately 50% of that shown by BDI. Animals receiving Fraction III showed a moderate but not a statistically significant reduction in heart rate (approximately 20% of that shown by BDI). Compared to BDI, those receiving Fraction II showed only a 10% reduction in heart rate. Saline injection failed to reduce heart rate (Table 7).

TABLE 7

GUINEA PIG STUDY: 5 x 5 LATIN SQUARE

MEAN CHANGES IN HEART RATES (Beats per Minute)

(Treatment Rates - Control Rates)

Post Injection Time	I	II	III	BDI	C	p<0.05
15 to 25 minutes	-34.4	-7.2	-15.2	-54.0	9.2	*
30 to 40 minutes	-29.4	-4.4	-9.2	-53.0	6.8	**
41 to 59 minutes	-25.0	-7.6	-11.4	-62.8	6.8	*
60 to 74 minutes	-19.8	2.2	-13.4	-53.8	4.4	N.S.
75 to 95 minutes	-23.4	-7.6	-10.2	-51.6	0.2	N.S.
Mean of Means	-26.4	-4.9	-11.9	-55.0	5.5	-

I = BDI - (BHB + MNC)
II = BHB
III = MNC through Wash
C = Saline Control

* *Treatments are significantly different at p<0.05*
** *Treatments are significantly different at p<0.01*

Food and Water Intake

Guinea pigs that received BDI showed a decreased intake of food that was significant by the third and fourth day post injection.

Water intake by guinea pigs that received BDI was not changed.

Urine urea to creatinine ratios were profoundly reduced in guinea pigs receiving BDI.

Tranquility (Table 8)

Only animals receiving BDI were rated more tranquil than those receiving saline.

TABLE 8

GUINEA PIG STUDY: 5 x 5 LATIN SQUARE TRANQUILITY			
Substance	Fraction	Number of Animals	Tranquility*
BDI	-	5	3.6
BDI - (BHB + MNC)	I	5	2.0
BHB	II	5	2.8
MNC	III	5	2.8
Saline (Control)	C	5	2.6

* *Animals rated 1 to 4 (anxious to tranquil) when exposed to a brief snapping sound and turned over on their backs*

Deaths

Two animals died within 24 hours. One received Fraction I; the other received BDI.

Summary

BDI demonstrated significant and profound reductions in body temperature when compared to its Fractions - I, II, or III.

The reductions in body temperature stimulated by BDI increased over time with temperatures remaining low for up to 24 hours.

Individual components of BDI (Fraction I, Fraction II, and Fraction III) had no effect on body temperature.

BDI demonstrated significant and profound reductions in heart rate when compared to its Fractions - I, II, or III.

Heart rates were reduced significantly within 30 to 60 minutes after the injection of BDI and tended to return to normal within two to three hours post injection.

In order of responses, Fraction I, Fraction III, and Fraction II reduced, but to a much lesser degree, heart rates independently.

The decrease in urea to creatinine ratios were profoundly reduced in guinea pigs receiving BDI.

Only BDI induced tranquility over that shown by animals receiving the saline control.

Conclusion

BDI contains components that target specific physiologic changes independently, but BDI exhibits the greatest overall effects when all the components of BDI are present. The performance of BDI exceeds the results of any of the above fractional components.

Study Four: Effects of Combination of Fraction I, Fraction II, and Fraction III Isolated From Urine In A Non-Hibernating Animal, the Guinea Pig

Introduction

Samples were defined as follows:

1. Combination A: Fraction I plus Fraction III representing BDI - BHB; contains MNC.
2. Combination B: Fraction I plus Fraction II representing BDI - MNC; contains BHB.
3. Combination C: Fraction II plus Fraction III representing BHB + MNC.

The above Combinations were obtained by combining appropriate samples from the second CCC run. They were dried as those for BDI. Thereafter, they were reconstituted in a saline solution.

Methods

BDI obtained from urine taken from early, mid, and late denning bears was used for isolation of Fraction I, Fraction II, and Fraction III. The combinations were injected intraperitoneally.

Body temperature (°C), heart rates (BPM), and tranquility were measured for each treatment on three guinea pigs.

Data were grouped into time categories: 0 minutes (pre-injection control), 30 minutes, 60 minutes, 75 minutes, and 260 minutes (post injection).

Each animal was used as its own control. Treatment means are reported as the difference of each treatment effect from the 0 minutes (control) result. Therefore, as in the Latin Square Study, positive or negative treatment mean values indicate an increase or decrease in the effect measured. A mean of the Combination means was then calculated from each Combination over all animals and all time categories. All research observers (blinded study) were asked to comment on each animals' tranquility by observing the animal handling and animal reaction when exposed to a loud snapping noise.

In these studies, comparison between guinea pigs, sample potency was expressed as the ratio of averaged treatment means to g dry weight of each sample injected.

Results

Temperatures (Table 9) were reduced in all three guinea pigs receiving Combination A, Combination B, and Combination C with the largest decreases in temperatures occurring in animals receiving Combination A or Combination B.

When temperature responses were related to weight of the injected sample (Table 9 - Potency), Combination A, Combination B, and Combination C were potent in reducing body temperatures. Combination C had the greatest potency (Table 9).

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TABLE 9

GUINEA PIG STUDY: COMBINED FRACTIONS CHANGES IN BODY TEMPERATURE (°C) AND POTENCY (Treatment Temperature - Control Temperature)			
Post Injection Time	Combination A	Combination B	Combination C
30 minutes	-0.21	-0.67	-0.17
60 minutes	-1.21	-1.68	-0.17
75 minutes	-1.60	-2.01	-0.34
260 minutes	-4.49	-3.63	-1.50
Mean	-1.88	-2.00	-0.55
Sample Weight	3.3833 g	1.9917 g	0.1699 g
Potency*	-0.56	-1.00	-3.24

Combination A = Fraction I + Fraction III = BDI- BHB (Contains MNC)
Combination B = Fraction I + Fraction II = BDI - MNC (Contains BHB)
Combination C = Fraction II + Fraction III = MNC + BHB (Through Wash)

Heart rates were reduced in all three guinea pigs. The largest reductions occurred in animals receiving combinations A and B (Table 10).

Combination C was most potent in reducing heart rate (Table 10).

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TABLE 10

GUINEA PIG STUDY: COMBINED FRACTIONS MEAN CHANGES IN HEART RATES (Beats per Minute) AND POTENCY (Treatment Rates - Control Rates)			
Post Injection Time	Combination A	Combination B	Combination C
30 minutes	-88.0	-54.0	-14.0
60 minutes	-70.0	-67.0	-50.0
75 minutes	-79.0	-60.0	-68.0
Mean of Means	-70.0	-60.3	-44.0
Sample Weight	3.3833 g	1.9917 g	0.1699 g
Potency*	-23.4	-30.3	-258.8

Combination A = Fraction I + Fraction III = BDI- BHB (Contains MNC)
Combination B = Fraction I + Fraction II = BDI - MNC (Contains BHB)
Combination C = Fraction II + Fraction III = MNC + BHB (Through Wash)

Combination A, Combination B, and Combination C produced tranquility in the animals (Table 11).

TABLE 11

GUINEA PIG STUDY: EFFECT OF COMBINED FRACTIONS, TRANQUILITY			
Substance	Combination	Number of Animals	Tranquility*
BDI - BHB (Contains MNC)	Combination A (Fraction I + Fraction III)	1	4.0
BDI - MNC (Contains BHB)	Combination B (Fraction I + Fraction II)	1	4.0
MNC + BHB	Combination C (Fraction II + Fraction III)	1	3.0

* *Animals rated (anxious to tranquil) when exposed to a brief snapping sound and turned over on their backs*

Animals receiving Combination A or Combination B died within 24 to 48 hours post injection.

Summary

Combination A, Combination B, and Combination C greatly reduced body temperature and heart rate.

Reductions in body temperature increased over time with temperatures remaining low for up to 24 to 48 hours.

Heart rates were reduced within 30 to 60 minutes after the injections and remained low throughout the 75 minutes that the animals were monitored.

Combination C gave the largest potency effect in temperature and heart rate reduction. The animal survived. This suggests that the components of Combination C may be the predominantly active ingredients in BDI containing no toxic side effects.

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Conclusions

BDI from urine and its combined components demonstrate dramatic decreases in body temperature and heart rate in non-denning guinea pigs.

BDI from urine and its combined components also produce alert tranquility in this non-denning animal model.

Study Five: Comparison of BDI Derived From Denning Serum and Serum From Active Bears In A Non-Hibernating Animal, the Guinea Pig

Methods

As previously described, equal volumes of BDI and summer active serum were processed by deproteinization, centrifugation, supernatant removed, lyophilization, and residue reconstitution into 2 ml of saline. The reconstituted samples were each intraperitoneally injected into guinea pigs. Body temperatures, heart rates, and tranquility ratings were recorded as described in Study One, Study Two, and Study Three.

Results

The mean decrease in body temperature associated with BDI was -0.19°C. This is approximately two-fold greater than the -0.10°C shown by serum from active bears and by saline controls in the Latin Square Design.

No significant change in heart rates occurred after injection. BDI was associated with an overall mean decrease of 8 beats/minute; active bear serum showed a mean decrease of 7 beats/minute.

Neither animal showed signs of tranquility.

Conclusions

BDI from serum showed only a mild response in lowering body temperature.

Active bear serum showed no response in lowering body temperature.

Neither BDI from serum nor active bear serum affected the heart rate or induced tranquility.

The lack of response may be attributable to an extremely low concentration of BDI in the samples.

Overall Conclusions of Guinea Pig Testing

When given intraperitoneally to the guinea pig, BDI induces the responses of the bear: tranquility, decreased heart rate, and decreased body temperature.

No differences in guinea pig results were noted when BDI was isolated from early, mid, or late denning bears.

BDI was most effective when used in full strength.

Isolated Fractions of BDI by themselves were inactive.

Combination of BDI into Combination A (Fraction I plus Fraction II), Combination B (Fraction I plus Fraction III), and Combination C (Fraction II plus Fraction III) also elicited positive results. Combination A and Combination B were associated with side effects which were, most likely, due to Fraction I. Three of seven animals died. They either received Fraction I or Combinations A and B that contained Fraction I.

A definite, safe, and highly active response with no observable side effects was noticed in the animal receiving purified Combination C (Fraction II plus Fraction III).

Treatment of Osteoporosis in Ovariectomized Rats

Our next step was to treat a living animal model similar to the post menopausal woman with BDI.

We used a pharmaceutical industry accepted animal model. Growing rats, less than six months old, were randomized into three groups of six rats each. One group was control (sham operated), one was ovariectomized, and one was ovariectomized and received BDI via subcutaneous injection. Similar volumes of saline were injected into the other two groups. BDI was given in amounts similar to its daily production in bears but proportionally scaled to body weight of the rat.

At the end of eight weeks, the ovariectomized group had become osteoporotic. When compared with this group, the ovariectomized group treated with BDI showed a 3% increase in bone mineral density (BMD) of the femur and a 4% increase in the lumbar vertebrae.

When compared with two month results of treating post menopausal women with estrogen, progesterone, and calcium, BDI results in rats showed a 16-fold greater increase in the BMD in lumbar vertebrae and a 3-fold greater increase in BMD of the femur. Another group of women on similar hormone replacement therapy showed only a 1.7% increase in BMD of the lumbar spine even though they were treated for 1.6 years.

In vitro Studies: Evaluation of BDI and Its Fractions In Stimulating Bone Remodeling

Introduction

These studies focused on serum and urine obtained from denning bears. The bone mass of denning bears remains constant even though they exist in a non-weight bearing state, a condition that induces loss of bone. Unlike other mammals, the bear maintains bone mass, structure, and strength. In the bear, the cells that produce bone (osteoblasts) are as active as the cells that resorb bone (osteoclasts). Under similar conditions, other mammals (including humans) lose bone by reducing bone formation, by maintaining or increasing bone resorption, or by a combination of these changes.

Test One: Inhibition of the Resorption Activity of Chicken Osteoclasts

Introduction

Unprocessed serum from active eating bears and unprocessed serum from denning bears both showed an inhibition of osteoclast resorption activity. The studies focused on the denning bear because it continues to make bone despite the fact that its non-weight bearing state lasts for months.

Methods

BDI Serum Studies (Table 12)

BDI, BHB, and BDI - BHB (containing MNC) were prepared from serum of bears as described under "Chemistry of the Invention" in this application.

Results

BDI from three bears in concentrations of 1 mg/ml of sample reduced osteoclast resorption activity to values of 24, 46, and 55 percent of control. More dilute samples were not effective (0.1, 0.01, 0.001 mg/ml).

The sample BDI - BHB that contains MNC also proved effective in two bears at concentrations of 1 mg/ml, reducing osteoclast resorption activity to 10 and 75 percent of control.

BHB by itself had no effect on osteoclast resorption.

TABLE 12

BEAR SERUM: INHIBITION OF FORMATION OF CHICKEN OSTEOCLASTS FROM CHICKEN MONOCYTES OBTAINED FROM BONE MARROW							
Substance	Bear Name	Weight (g)	CCC Samples	Percent Reduction from Control Concentration of Test Sample (mg/ml)			
				0.001	0.01	0.1	1.0
BDI	Amanzo	0.017	not run	125	115	108	55
	Caruso	0.012	not run	80	106		46
	UP	0.020	not run	152	93	90	24
BDI - BHB (Contains MNC)	Amanzo	0.026	Fraction I and III	119	103	108	75
	UP	0.078	Fraction I and III	84	90	60	10
BHB	Amanzo	0.0006	Fraction II		130	130	135
	Caruso	0.0023	Fraction II		95	95	
	UP	0.002	Fraction II	80	105	110	

Conclusion

Direct action of BDI isolated from serum with or without BHB produced an environment conducive for bone formation by inhibiting resorption activity of osteoclasts, the cells that dissolve bone.

BDI Urine Studies (Table 13)

Methods

BDI was prepared from urine from three bears as described previously under "Chemistry of the Invention" of this application.

Results

BDI in concentrations of 10 mg/ml of sample inhibited resorption activity of osteoclasts to values of 25, 35, and 38 percent of control. More dilute samples were not effective (Table 13).

TABLE 13

BEAR URINE: INHIBITION OF FORMATION OF CHICKEN OSTEOCLASTS FROM CHICKEN MONOCYTES OBTAINED FROM BONE MARROW							
Substance	Bear Name	Sample Weight (g)	Percent Reduction from Control Concentration of Test Sample (mg/ml)				
			0.01	0.1	1	3	10
BDI	Amanzo	0.268	147	110	130	95	25
	Caruso	0.255	125	85			35
	UP	0.270	123	107			38

<u>Conclusions</u>

BDI isolated from urine induces bone formation by <u>inhibiting</u> bone resorption by osteoclasts.

BDI isolated from serum is approximately 10 times more effective than BDI isolated from urine in reducing bone resorption by osteoclasts.

<u>Test Two: Simultaneous Evaluation of Osteoblast and Osteoclast Activity</u>

<u>Methods and Materials</u>

Experiments utilized an *in vitro* bone culture system. Calvaria (skull) of 4 to 6 day old neonatal mice were dissected out and cultured in individual capped test tubes in 2 ml of culture media (DMEM + glutamine, heparin, inactivated horse serum, and antibiotics). Each calvaria was gassed and incubated in a rotating roller drum at 37°C. Osteoblast activation (increased bone formation) was evaluated as a function of alkaline phosphatase activity (ALP). Osteoclast activity (bone resorption) was evaluated as a function of beta-glucuronidase activity. For testing purposes, two samples of serum from bears were used: 1) unprocessed bear serum, and 2) processed bear serum (BDI). Horse serum was used as a serum control to ensure that stimulation was not due to serum growth factors.

Results

Unprocessed bear serum from active, eating, weight-bearing bears increased ALP activity from 600 to 1200 nmole ALP/bone/30 minutes.

Unprocessed bear serum from denning, non-eating, non-active, non-weight bearing bears also significantly increased ALP activity from 600 to 1200 nmole ALP/bone/30 minutes.

Horse serum showed no change in ALP activity.

Unprocessed bear serum from denning bears showed a dose response result. The saline control value of 250 ALP/bone/30 minutes significantly increased to 600, to 800, and to 1000 ALP/bone/30 minutes in response to 50, 100, and 200 μl of serum respectively.

BDI increased ALP activity from 310 to 520 ALP/bone/30 minutes, about 55% of the response elicited by unprocessed bear serum that, in the same test, increased ALP to 700 ALP/bone/30 minutes.

The ability of BDI to increase ALP activity proved significantly greater than effects of calcitonin.

Inactivating serum proteins in unprocessed bear serum by heat produced results similar to BDI; ALP activity increased.

BDI failed to activate beta-glucuronidase. Combining these findings with the above indicated that BDI primarily stimulated bone formation by osteoblasts.

Unprocessed serum from active and denning bears showed both mild stimulation and failure to stimulate beta glucuronidase activity. However, when osteoclasts were stimulated, the response was less than one-half of the osteoblast stimulatory response. Therefore, bone formation activity continued to exceed bone resorbing activity.

Conclusions

Unprocessed serum from active and denning bears stimulates osteoblasts.

Unprocessed serum from active and denning bears varied in its ability to stimulate osteoclasts. At times no changes were observed; at other times mild stimulation was observed.

BDI stimulates osteoblasts to about 55% of that shown by unprocessed serum.

BDI does not stimulate osteoclasts.

The overall effect on bone remodeling is creation of an environment conducive to bone formation - stimulation of the limb that forms bone (osteoblasts) while not stimulating bone resorption (osteoclasts).

Test Three: The Effect of Summer Fasted BDI on Osteoblast and Osteoclast Activities

Introduction

As previously described, fasted bears (who had access to water) during the summertime revealed changes in levels of serum urea, creatinine, and a U/C ratio similar to changes noted when bears were denning. Thus, it was concluded that the summer fasting bears were in the mode of urea recycling (See Tables 1 and 2). Test Three was done to determine if bone remodeling was also stimulated when the bears were fasting. The effect of the 21 day summer fast on bone remodeling was determined by evaluating the activity of BDI obtained from these bears in an *in vitro* bone culture system.

Materials and Methods

As described in the discussion Test Two, calvaria of 4 to 6 day old neonatal mice were used for the *in vitro* bone culture system. Alkaline phosphatase activity (ALP) was used as a means of evaluating osteoblast activity (increased bone formation).

Because previous tests using beta glucuronidase activity to evaluate osteoclast activity (increased bone resorption) were inconclusive, a more sensitive test was employed. The production of tartrate resistant acid phosphatase (TRAP) was used as a measure of osteoclast activity (Lau et al., 1987; Delamis 1988). For testing purposes, BDI was prepared from urine of bears before and at the end of the 21 day fast. Denning bear plasma served as a positive control. Pre-fasted BDI was compared with fasted BDI. Both were compared with denning bear plasma and all three samples were compared with the phosphate buffered saline control.

Results

Osteoblast Results (Table 14)

Pre-fasted BDI results were similar to results of denning bear plasma. Both showed a moderate, significant increase in osteoblast activity (55% and 50% above control respectively). However, BDI from the final day of fasting significantly stimulated osteoblasts some 300% above control, about a six-fold increase over results from denning bear plasma or pre-fasted BDI.

TABLE 14

Changes in Medium Alkaline Phosphatase Activity In Calvaria Incubated with Normal Denning Bear Plasma and BDI Processed from Urine Before and At the End of a 21-Day Fast

Treatment Group	ALP Activity[1]
PBS (Phosphate Buffered Saline)	444.8[a] ± 108.5
BP (Denning Blood Plasma)	666.4[a,b] ±127.2
Fasted (BDI from Urine of Fasted Bears)	1337.7[c] ± 346.3
Pre-Fasted (BDI from Urine of Non-Fasting Bears)	690.9[b] ± 120.9

[1] nmol of p-nitrophenol/30 min/bone
Different letters indicate a significant difference, $p<0.05$, $n=6$

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Osteoclast Results (Table 15)

When using TRAP as an indicator of osteoclast activity, results clearly demonstrate BDI's ability to inhibit osteoclast function. Both the fasted and pre-fasted results showed similar, significant inhibitory effects on osteoclast function, reaching levels 40% to 46% of normal. These results confirmed results using the chicken osteoclast tissue culture assay (Tables 12 and 13) as an indicator of osteoclast activity. Denning bear plasma showed no effects on osteoclast function.

TABLE 15

Changes in Medium Tartate Resistant Acid Phosphatase Activity In Calvaria Incubated With Normal Denning Bear Serum and BDI Processed from Urine Before and at the End of a 21-Day Fast

Treatment Group	TRAP Activity[1]
PBS (Phosphate Buffered Saline)	142.5 [a] ±53.5
BP (Blood Plasma)	182.8[a] ± 58.2
Fasted (BDI from Urine of Fasted Bears)	77.4[b] ± 4.1
Pre-Fasted (BDI from Urine of Non-Fasting Bears)	84.0[b] ± 4.9

[1]nmol of p-nitrophenol/60 min/bone

Different letters indicate a significant difference from the phosphate buffered saline control, $p<0.05$, $n=6$

Conclusions

Summer fasting in black bears induces a significant increase in potency of BDI in stimulating bone formation through activation of osteoblasts. Simultaneously, BDI significantly inhibits osteoclast activity. Thus, fasting in summer potentiates BDI's ability to stimulate bone formation.

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Overall Conclusions of Bone Remodeling Studies

Results of the two separate studies independently performed at two institutions in two different states show complementary findings that support the conclusion that BDI stimulates bone formation and inhibits bone resorption since: BDI stimulates osteoblasts to form bone, BDI does not stimulate osteoclasts already present in bone, BDI inhibits resorption of bone by osteoclasts, and the net effect of these changes is to form bone. Summer fasting induces similar results in bone remodeling.

BDI is extremely potent since it stimulates the bone forming process while simultaneously inhibiting the bone resorption process of bone remodeling. Summer fasting in bears duplicates these positive findings found in denning bears.

Occurrence of Fraction II (BHB) and Fraction III (MNC) In Fasting, Adult Humans

Methods and Materials

Initially, BHB was identified by TLC/ninhydrin in very low concentrations in serum samples obtained from two humans that fasted for 20 hours. The serum samples were also deproteinated using the same method established for BDI. A follow-up study was done in fifty adult humans who had fasted for twenty hours to determine if components contained in BDI, namely BHB and MNC, could be found.

Results

MNC was not detected in the serum of fasting humans.

BHB appeared in serum samples obtained from subjects after a food restricted 20 hour fast.

BHB was not detected in serum samples obtained from subjects in the fed state.

Little to no BHB was detected in the urine of subjects collected before and after the 20 hour fast.

Conclusions

MNC, found in BDI, was not found in fasting human serum or urine.

Serum and urine from fasting humans contains BHB.

Dosage Formulations

After BDI (containing both BHB and MNC) alone or in combination with existing identified metabolites of denning bears which are also found in humans, has been isolated as set forth above, it is combined with desirable solvents such as saline or 5% dextrose in water.

After the solvents have been applied, a carrier may also be involved. Such carriers include: peanut oil, propylene glycol, a 5% alcohol based elixir, or pills and capsules containing lactose and/or calcium carbonate fillers. Transdermals are available as an alternative means of delivering the necessary doses of BDI. For subcutaneous, intramuscular, intravenous, or other specialized routes such as into the cerebral spinal fluid, appropriate carriers such as saline, Ringer's lactate, or dextrose solutions may be used. BDI is stable, water soluble, and will not suffer dissolution after stirring or settling overnight.

Once the syringe has been loaded, or the pill compounded, the maximum dosages (which must first be assessed for safety) are calculated for the animal to be tested. The present means to predict maximum dosage was based only on the lyophilized BDI contained in aliquots of 50 ml of denning bear urine that also contained 200 micrograms (μg) of MNC. Next, the blood volume of the recipient is equated with 50 ml urine volumes from the bear. The concentration of MNC in 50 ml of urine is used for calculations.

Mammals have blood volumes of approximately 5% of total body weight. Therefore, a 1000 gram guinea pig has 0.05 x 1000 g = 50 ml blood.

Fifty milliliters of denning bear urine containing between 2.0 and 3.6 grams of BDI also contains 200 micrograms (μg) MNC or 4 μg/ml.

Therefore, the dosage and formulation for a 1000 gram guinea pig was BDI containing 200 μg MNC, which equaled a dose of 0.2 μg MNC/g body weight.

<u>Reaffirmation of Findings: Urea recycling is produced when BDI injected into guinea pigs but not necessarily its basic components.</u>

A urea creatinine ratio indicative of urea recycling (10 or less) was produced when BDI was injected into guinea pigs. This effect of efficient recycling lasted for three days after the injection. BDI was then separated into its three basic components. These were done previously as set forth in connection with the Table 1. The three basic components were BDI minus (BHB + MNC); BHB; and MNC. When each of these three basic components was injected separately into guinea pigs, the urine of guinea pigs did not exhibit a urea to creatinine ratio indicative of urea recycling (see Table 16).

TABLE 16

Urine Urea to Creatine Ratio in Guinea Pigs For Three Days Post-Injection

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Treatment	Day 1	Day 2	Day 3
Control: Average U/C Ratio	34.28	34.28	34.28
Group A: BDI-(BHB + MNC) (Contains 0.185 g urea)	26.33	22.13	26.09
Group B: BHB	31.86	29.45	23.69
Group C: MNC Through Wash	26.23	33.20	34.55
Group D: BDI (Contains 1.1 g urea)	8.33	12.25	7.66
Group E: Saline Control	17.39	13.01	14.93

Thus, the combination of some substances contained in Fractions 1-17 of Table 1 (BDI minus [BHB + MNC]) and some substances from the fractions associated with BHB and/or MNC stimulate urea recycling.

Some of the individual components of these fractions are now known. The combination of the active substances in each fraction will stimulate urea recycling in the guinea pig, as distinguished from the lack of significant recycling when the three separate components are injected separately.

<u>Further Refinement of Separation Techniques for BDI Isolated from Denning Bear Urine to: 1) Search for the Fractions in BDI Responsible for Stimulation of Osteoblasts, 2) Identify Known Chemicals in the Ten Fractions of BDI, and 3) Further Purify the Fractions of BDI by HPLC in order to Identify Structural Components of MNC by Nuclear Magnetic Resonance and Mass Spectrometry</u>.

Chemical methods of obtaining BDI fractions and isolating the same were performed as previously set forth in Table 1. To support further analysis, ten newly defined fractions from the countercurrent coil were collected. For example, the new Fraction I was

obtained by pooling the first five elutions acquired from the countercurrent centrifuge. Total volume per collection tube was 20 ml; therefore, Fraction I contains 100 ml.

The precise countercurrent apparatus and centrifuge is manufactured by P.C., Inc. of Potomac, Maryland, referred to as a Multi-Layer Coil CCC. The #10 coil having a volume of 385 ml was used in processing all of the elutions and rinse which resulted in new Fractions I-X (Table 17).

TABLE 17

Separation of BDI Into Ten Fractions After CCC

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New Fractions	CCC Fractions
Fraction I	1 - 5
Fraction II	6 - 10
Fraction III	11 - 15
Fraction IV	16 - 20
Fraction V	21 - 25
Fraction VI	26 - 30
Fraction VII	31 - 35
Fraction VIII	36 - 40
Fraction IX	41 - 45
Fraction X	Methanol Wash

The mobile phase (lower phase of 1-butanol:water:acetic acid, 20:20:1 mixture) of the first six of ten fractions were pumped through the CCC at 4 ml/minute. Collections were taken every twenty-five minutes. After collection of Fraction VI, the coil was stopped. Mobile phase continued pumping at an increased rate of 10 ml/minute. Collections were made at ten minute intervals. The mobile phase was discontinued while a 1:1 mixture of methanol and water was begun before beginning collection of Fraction IX. The methanol/water mixture was switched to 100% methanol at the beginning of Fraction X. After ten minutes, the pump was stopped and the coil was emptied by forcing compressed

air through it. Everything collected from the coil at this point was added to Fraction X. All fractions were stored at -70°C until lyophilization.

Search for Site of Osteoblast Stimulation in BDI

A sample of urine collected from a single denning bear was deproteinated and lyophilized. Up to one gram of BDI was then loaded on the CCC and separated into ten fractions through the procedure diagrammed in Table 17. Weights were obtained for each fraction. Fractions obtained from four separate runs of the CCC were combined before use in osteoblast cultures.

Each combined fraction was tested in a mouse calvaria bioassay to determine its effectiveness in stimulating osteoblasts. An increase in alkaline phosphatase production was interpreted as osteoblast stimulation.

The ability of each combined fraction to stimulate alkaline phosphatase in the mouse calvaria bioassay was measured and expressed as a percent of control. This was compared to the ability of BDI and of pooled blood serum from denning bears to stimulate alkaline phosphatase in the mouse calvaria bioassay (Table 18).

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TABLE 18

Percent Stimulation of Osteoblast Activity By Blood Serum, Bear Derived Isolate, and Its Fractions

Sample	Percent Above Control/mg Specimen
Fraction III	23
Fraction II	78
BDI (Bear Derived Isolate)	75
BS (Blood Serum)	322
Fraction X	292
Fraction IV	401
Fraction IX	571
Fraction V	3,740
Fraction VI	4,281
Fraction VII	37,432

Fraction II,

BDI,

Pooled blood serum from denning bears,

Fraction X,

Fraction IV,

Fraction IX,

Fraction V,

Fraction VI, and

Fraction VII

demonstrated stimulation of osteoblast activity. Fraction III inhibited osteoblast activity. Thus, Fraction III has the potential to arrest Paget's disease and other forms of neoplasms

such as cancer resulting from overactivity of osteoblastic-induced bone growth. For a list of substances identified for Fraction III see Tables 19 and 20.

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TABLE 19

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION III, BEAR URINE
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	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	0	0-75
PYRUVIC ACID	0	0-20
GLYCOLIC ACID	6	0-50
ALPHA-OH-BUTYRIC	0.0	0-1
OXALIC	0.0	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	0.2	0-11
5-HYDROXYCAPROIC	4.4	0-1
OCTANOIC	0.0	0-1
BETA-LACTATE	0.0	0-8
SUCCINIC ACID	0	0-20
GLUTARIC ACID	0.4	0-2
2-OXO-GLUTARATE	0	0-210
FUMARIC	0.0	0-5
MALEIC	0.0	0
MALIC ACID	28.1	0-2
ADIPIC ACID	0.0	0-7
SUBERIC ACID	1.0	0-11
SEBACIC ACID	0.0	0-2
GLYCERIC ACID	0	0-4
BETA-OH-BUTYRIC	0	0-3
METHYLSUCCINIC	0.0	0
METHYLMALONIC	0	0-5
ETHYLMALONIC	0.0	0-4
HOMOGENTISIC ACID	0.0	0-1
PHENYLPYRUVIC ACID	0.1	0-1
SUCCINYLACETONE	0.0	0-1
3-OH-ISOVALERIC	0.0	0-21
PHOSPHATE	90	0-3000
CITRIC ACID	24	0-450
HIPPURIC ACID	11	0-2000
URIC ACID	0	0-360
Nutritionals		
KYNURENIC ACID	0.6	
FORMIMINOGLUTAMIC	0.15	0-3
4-PYRIDOXIC ACID	0.2	0-9
PANTOTHENIC ACID	14	0-30
XANTHURENIC ACID	0.0	0-1
KYNURENINE	0.1	0-1
QUINOLINIC	0.0	0-6
OROTIC ACID	0.00	0-3
D-AM LEVULINIC	4.0	0-18
3-METHYL HISTIDINE	0	0-75
NIACINAMIDE	0.0	0-1
PSEUDOURIDINE	58	10-220
2-DEOXYTETRONIC	0	0-75
P-HO-PHEN-ACETIC	0	0-12
XANTHINE	0	0-18
UROCANIC ACID	0	0-3
ABSCORBIC ACID	1	0-160
GLYCEROL	0	0-9
Carbohydrates		
THREITOL	0	0-40
ERYTHRITOL	0	0-55
ARABINOSE	0	0-30
FUCOSE	0.7	0-12
RIBOSE	3.2	0-12
XYLOSE	0	0-70
FRUCTOSE	0	0-115
GLUCOSE	3	0-110
GALACTOSE	20	0-200
MANNOSE	10	0-70
N-AC-GLUCOSAMINE	1.0	0-3
LACTOSE	2	0-60
MALTOSE	1	0-40
XYLITOL	0.1	0-15

	mM/M CREATININE	Nrml Range
ARABINITOL	0.0	0-30
RIBITOL	0.0	0-10
ALLOSE	1.4	0-10
GLUCURONIC ACID	113.6	0-50
GALACTONIC ACID	12	0-60
GLUCONIC ACID	5.2	0-35
GLUCARIC	2.2	0-5
MANNITOL	11.5	0-15
DULCITOL	2.2	0-10
SORBITOL	3.2	0-10
INOSITOL	3.4	0-12
SUCROSE	0	0-75
Neurotransmitters		
GABA	0.0	0-1
HOMOVANILLIC ACID	0.0	0-10
NORMETANEPHRINE	0.0	0-1
VANILLYLMANDELIC	0.0	0-6
METANEPHRINE	0.1	0-2
5-HIAA	0.0	0-6
MHPG	0.0	0-1
ETHANOLAMINE	0	10-90
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	0.3	0-1
BUTYRYL GLYCINE	0.1	0-1
HEXANOYL GLYCINE	0.1	0-1
PHENYL PROP GLY	0.0	0-1
SUBERYL GLYCINE	0.0	0-1
ISOVALERYL GLY	0.0	0-1
TIGLY GLY	0.0	0-1
BETA MET CROT GLY	0.0	0-1
GLYCINE	1	0-500
ALANINE	2	0-130
SARCOSINE	0.0	0-8
BETA-ALANINE	0.1	0-2
B-AMINOISOBUTYRIC	0	0-50
SERINE	0	0-85
PROLINE	0.0	0-8
HYDROXY PROLINE	0	0-75
HYDROXY LYSINE	0.1	0-1
ASPARTIC ACID	0.0	0-2
ASPARAGINE	0.0	0-2
N-AC ASPARTIC	0.0	0-20
ORNITHINE	0.1	0-5
GLUTAMIC ACID	0.1	0-6
GLUTAMINE	1	0-210
PIPECOLIC ACID	0.1	0-1
LEUCINE	0.0	0-9
KETO LEUCINE	0.0	0-1
VALINE	0.0	0-18
KETO-VALINE	0.0	0-1
ISOLEUCINE	0.0	0-5
KETO-ISOLEUCINE	1.0	0-1
LYSINE	1	0-35
HISTIDINE	1	0-225
THREONINE	0	0-45
HOMOSERINE	0.3	0-1
METHIONINE	0.0	0-3
CYSTEINE	0	0-160
HOMOCYSTEINE	0.0	0-1
CYSTATHIONINE	0.1	0-1
HOMOCYSTINE	0.0	0-1
CYSTINE	0.1	0-5
PHENYLALANINE	16	0-20
TYROSINE	1	0-22
TRYPTOPHAN	0	0-25

TABLE 20

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION III, BEAR URINE
JZ4061

CONCENTRATION: THIS SAMPLE CONTAINED 20.72 mM CREATININE/mL

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA OF CREAT
18	24, NU3131	2125	767	1.18	72.24
25	25	0	0	2.75	167.69
32	32	0	0	0.07	4.42
57	57	0	0	0.14	8.41
68	1,3 PROPANEDIOL DI-TMS	1675	854	0.35	21.28
78	78	0	0	0.30	18.24
83	PROPENE GLYCOL DI-TMS	50	868	0.86	52.40
94	GLYCOLIC ACID DI-TMS	55	925	1.83	111.85
97	GLYCOLIC ACID DI-TMS	55	947	1.46	88.88
101	92, NA3011	2070	711	0.09	5.63
112	104, NJ3031	2131	834	1.87	114.25
181	107, KA1051	2050	712	0.08	4.73
243	4-HYDROXY BUTYRIC ACID DI-TMS	97	799	0.12	7.40
257	MALONIC ACID DI-TMS	100	760	0.09	5.38
323	PHOSPHATE TRI-TMS	1413	929	0.16	9.94
351	PHOSPHATE TRI-TMS	1413	834	0.13	7.80
357	PHOSPHATE TRI-TMS	1413	852	0.60	36.50
362	PHOSPHATE TRI-TMS	1413	925	0.41	25.17
382	PHOSPHATE TRI-TMS	1413	933	0.08	4.58
387	PHOSPHATE TRI-TMS	1413	804	0.70	42.71
409	409	0	0	0.23	14.03
423	409, JZ4061	2327	959	0.73	44.75
430	409, JZ4061	2327	928	0.58	35.39
462	283, NF3091	2093	733	0.12	7.05
486	GLYCERIC ACID TRI-TMS	324	626	0.75	45.99
513	283, NF3091	2093	747	0.11	6.47
527	283, NF3091	2093	745	0.18	11.14
600	2, 4 DIHYDROXYBUTYRIC ACID TRI-TMS	1889	922	0.23	13.89
628	628	0	0	0.09	5.22
638	3, 4 DIHYDROXY BUTYRIC ACID TRI-TMS	361	887	0.88	53.73
658	CITRAMALIC ACID TRI-TMS, 675	2103	703	0.13	8.17
664	645, M27041	1836	863	0.13	7.74
694	CITRAMALIC ACID TRI-TMS, 675	2103	940	0.17	10.30
738	2-DEOXY PENTONIC ACID GAMMA LACTONE DI-TMS	176	795	0.15	8.91
764	1-AMINO CYCLOPENTANE CARBOXYLIC ACID DI-TMS	158	614	4.40	268.70
773	TETROSE TRI-TMS	362	938	3.31	202.06
787	TETROSE TRI-TMS	362	941	9.36	571.10
800	3-METHYL-2-TENTENEDIOIC ACID DI-TMS	2004	726	0.07	4.32
813	CREATININE ENOL TRI-TMS	1467	865	1.68	102.41
819	TETROSE TRI-TMS	362	683	1.09	66.57
825	4 DE-O TETRONIC TMS3, THREO	1649	671	0.65	39.52
836	4 DE-O TETRONIC TMS3, THREO	1649	902	5.55	338.69
859	4 DE-O TETRONIC TMS3; THREO	1649	886	1.97	120.42
886	ALANINE DI-TMS	78	546	0.08	5.08
903	PARA HYDROXY BENZOIC DI-TMS	202	635	0.07	4.53
910	D-ERYTHRO-PENTITOL, 2-DEOXY-1, 3, 4, 5-TETRAKIS-	633	742	0.31	18.65
927	2, 2 DIMETHYL 3-HYDROXY BUTRIC ACID DI-TMS	180	546	0.58	35.27
943	LACTULOSE METABOLITE?	1751	847	0.76	46.27
951	ARABINOFURANOSE TETRA-TMS	675	855	0.26	16.12
963	GLYCOLIC ACID DI-TMS	55	319	0.97	59.40
972	981, M21021	1829	752	0.46	27.86
985	RIBULOSE PER-TMS	1848	749	0.88	53.83
996	996	0	0	1.31	79.71
1005	965, JJ4011	2191	708	0.27	16.69
1011	ARABITOL	1841	752	0.31	19.21
1019	ARABITOL	1841	664	0.15	9.44
1024	1024	0	0	0.30	18.25
1034	D-ERYTHRO-HEX-2-ENOUIC ACID, DI-O-METHYLBIS-O	404	581	0.07	4.18
1041	6-DEOXY MANNOSE TETRA-TMS	719	873	0.28	16.91
1054	ARABITOL	1841	959	2.43	148.36
1060	ARABINONIC ACID, 2, 3, 5-TRIS-O-TMS-, .GAMMA. -L	464	731	0.17	10.45
1072	ARABITOL	1841	951	4.16	254.05
1077	1073, RT1051	2040	732	2.02	123.07
1099	CYSTEINE TRI-TMS	363	295	1.13	68.83
1107	D-XYLOPYRANOSE TETRA-TMS	679	783	0.93	56.63
1119	1357, M22011	1834	739	2.21	134.78

Table 20, cont.

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION III, BEAR URINE
JZ4061

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA OF CREAT
1126	6-DEOXY GLUCIOL PENTA-TMS	858	913	1.24	75.79
1131	1107, NU3081	2122	683	1.62	99.10
1138	4 DE-O TETRONIC TMS3, THREO	1649	691	0.97	59.50
1142	1142	0	0	0.11	6.54
1160	PROPANOIC ACID, 3- BIS TMS-OXY PHOSPHINYL OX	756	696	0.14	8.75
1167	CREATININE TETRA-TMS	1438	603	0.87	52.90
1176	ISO CITRIC ACID TETRA-TMS	775	891	3.14	191.49
1185	D-ARABINO-HEXITOL, 2-DEOXY-1, 3, 4, 5, 6-PENTAKIS	856	584	0.45	27.57
1195	1195	0	0	0.13	7.81
1203	1357, M22011	1834	683	1.48	90.53
1226	1224, YE1011	1884	638	0.99	60.32
1234	1234	0	0	0.08	5.12
1246	1246	0	0	0.99	60.46
1254	GALACTOSE PENTA-TMS	878	707	0.57	34.80
1258	NEO-INOSITOL HEXA-TMS	972	835	1.15	70.49
1269	BENZOIC ACID, 5-METHOXY-2- TMS-OXY - TRIMETH	293	336	0.33	20.21
1276	GLUCONIC ACID, 2, 3, 5, 6-TETRAKIS-O-TMS- LACTO	737	816	0.73	44.42
1288	3, 4, 5 TRIHYDROXY FURAN 2-ACETALDEHYDE TETRA-T	743	680	0.31	18.72
1301	GLUCITOL TRI-TMS	979	899	1.51	92.20
1308	GLUCITOL TRI-TMS	979	895	1.60	97.44
1312	DULCITOL	1840	926	0.78	47.33
1318	1315, YE1011	1885	837	0.55	33.52
1325	2-DEOXY ERYTHROPENTONIC ACID TETRA-TMS	687	446	0.59	36.15
1334	GALACTONIC ACID HEXA-TMS	988	888	3.31	201.84
1354	TALOSE PENTA-TMS	896	883	0.45	27.31
1369	GALACTONIC ACID HEXA-TMS	988	789	0.58	35.69
1377	GALACTARIC ACID HEXA-TMS	993	772	0.46	27.82
1384	GALACTONIC ACID HEXA-TMS	988	811	0.83	50.75
1391	2-DEOXY ERYTHROPENTONIC ACID TETRA-TMS	687	529	0.20	12.26
1395	SCYLLO-INOSITOL HEXA-TMS	969	799	1.35	82.37
1403	.BETA.PHENYLPYRUVIC ACID DI-TMS	280	205	0.59	36.22
1424	ARABITOL	1841	584	1.31	79.85
1438	ARABITOL	1841	548	0.78	47.66
1443	MUCO-INOSITOL HEXA-TMS	974	802	0.98	59.86
1451	XYLULOSE TETRA-TMS	1771	658	0.17	10.36
1460	1460	0	0	0.08	4.63
1473	1473	0	0	0.06	3.85
1484	1484	0	0	0.07	4.16
1504	1504	0	0	0.07	4.18
1553	.BETA. -D-GALACTOFURANOSE, 1, 2, 3, 5, 6-PENTAKIS-	880	625	0.09	5.69
1561	1561	0	0	0.29	17.73
1591	1591	0	0	0.06	3.84
1596	PSEUDO URIDINE PENTA-TMS	1779	792	1.91	116.63
1615	D-RIBOFURANOSE TETRA-TMS	685	762	0.65	39.75
1658	1658	0	0	0.27	16.45
1704	D-XYLOPYRANOSE TETRA-TMS	679	650	0.08	4.71
1726	ARABINONIC ACID, 2, 3, 4-TRIS-O-TMS-, LACTONE,	461	629	0.08	5.11
1801	6-DEOXY MANNOSE TETRA-TMS	719	855	0.20	12.13

*The named compound matches the sample peak with a reliability given by "FIT"/1000

When results of this bioassay were expressed per mg of sample to represent potency of the sample, Fraction V, Fraction VI, and Fraction VII demonstrated the highest potency (Table 18). Fraction V exhibited a fifty-fold increase in potency when compared with BDI and a twelve-fold increase over the pooled denning bear serum. Similarly, Fraction VI exhibited a fifty-seven fold increase in potency when compared with BDI and a thirteen-fold increase over the pooled denning bear serum; Fraction VII exhibited a five hundred fold increase in potency when compared with BDI and a one hundred seventeen fold increase over pooled denning bear serum.

Identification of Known Substances in the Ten Fractions of BDI

The ten fractions of BDI collected from the CCC (including Fraction III above) were submitted to Dr. James Shoemaker, Director of the Metabolic Screening Laboratory and Assistant Professor of Biochemistry and Medicine in the College of Medicine, St. Louis University, St. Louis, Missouri, for analysis by gas chromatography and mass spectrometry (GC/MS). The mass spectra of trimethylsilyl derivatives of the compounds in the CCC fractions were compared to a database of more than forty thousand chemicals.

Tables 21 and 22 depict data generated from Fraction V. Tables 23 and 24 depict data generated from Fraction VI; Tables 25 and 26 depict data generated from Fraction VII. Data on retention times are available for the substances depicted in Tables 19 through 38.

TABLE 21

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION V, BEAR URINE
JZ4081:7

	um/L*	Nrml Range
Organic Acids		
LACTIC ACID	55124	
PYRUVIC ACID	10460	
GLYCOLIC ACID	1123	
ALPHA-OH-BUTYRIC	1274.5	
OXALIC	0.0	
4-OH-BUTYRIC	0.0	
HEXANOIC ACID	0.0	
5-HYDROXYCAPROIC	0.0	
OCTANOIC	0.0	
BETA-LACTATE	0.0	
SUCCINIC ACID	23256	
GLUTARIC ACID	0.0	
2-OXO-GLUTARATE	*****	
FUMARIC	0.0	
MALEIC	0.0	
MALIC ACID	0.0	
ADIPIC ACID	0.0	
SUBERIC ACID	0.0	
SEBACIC ACID	0.0	
GLYCERIC ACID	0.0	
BETA-OH-BUTYRIC	2026.0	
METHYLSUCCINIC	0.0	
METHYLMALONIC	0.0	
ETHYLMALONIC	0.0	
HOMOGENTISIC ACID	0.0	
PHENYLPYRUVIC ACID	0.0	
SUCCINYLACETONE	0.0	
3-OH-ISOVALERIC	231.5	
PHOSPHATE	2.19	mg/dL
CITRIC ACID	2865	
HIPPURIC ACID	486	
URIC ACID	0.59	mg/dL
Nutritionals		
FORMIMINOGLUTAMIC	0.00	
4-PYRIDOXIC ACID	0.0	
PANTOTHENIC ACID	0	
XANTHURENIC ACID	0.0	
KYNURENINE	0.0	
QUINOLINIC	1871.0	
OROTIC ACID	0.0	
D-AM LEVULINIC	*****	
3-METHYL HISTIDINE	*****	
NIACINAMIDE	1121.0	
PSEUDOURIDINE	11063	
2-DEOXYTETRONIC	0	
P-HO-PHEN-ACETIC	30	
XANTHINE	0	
UROCANIC ACID	0	
ABSCORBIC ACID	0	
GLYCEROL	7963.0	
Carbohydrates		
THREITOL	0	
ERYTHRITOL	0	
ARABINOSE	0	
FUCOSE	0.0	
RIBOSE	0.0	
XYLOSE	0	
FRUCTOSE	0	
GLUCOSE	23	mg/dL
GALACTOSE	0	
MANNOSE	84	
N-AC-GLUCOSAMINE	0.0	
LACTOSE	2869	
MALTOSE	3113	
XYLITOL	0.0	
ARABINITOL	0.0	
RIBITOL	0.0	
ALLOSE	105.0	

	um/L*	Nrml Range
GLUCURONIC ACID	2467.5	
GALACTONIC ACID	0	
GLUCONIC ACID	0.0	
GLUCARIC	0.0	
MANNITOL	69.5	
DULCITOL	0.0	
SORBITOL	0.0	
INOSITOL	0.0	
SUCROSE	6311	
Neurotransmitters		
GABA	562.0	
HOMOVANILLIC ACID	0.0	
NORMETANEPHRINE	0.0	
VANILLYLMANDELIC	*****	
METANEPHRINE	20.0	
5-HIAA	0.0	
MHPG	500.0	
ETHANOLAMINE	8655	
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	863.0	
BUTYRYL GLYCINE	*****	
HEXANOYL GLYCINE	856.5	
PHENYL PROP GLY	0.0	
SUBERYL GLYCINE	49.0	
ISOVALERYL GLY	0.0	
TIGLY GLY	*****	
BETA MET CROT GLY	0.0	
GLYCINE	15925	
ALANINE	192	
SARCOSINE	86.0	
BETA-ALANINE	0.0	
B-AMINOISOBUTYRIC	798	
SERINE	12428	
PROLINE	1351.0	
HYDROXY PROLINE	15079	
HYDROXY LYSINE	0.0	
ASPARTIC ACID	3027.5	
ASPARAGINE	0.0	
N-AC ASPARTIC	0.0	
ORNITHINE	393.5	
GLUTAMIC ACID	952.5	
GLUTAMINE	577	
PIPECOLIC ACID	0.0	
LEUCINE	1799.0	
KETO LEUCINE	*****	
VALINE	3449.0	
KETO-VALINE	0.0	
ISOLEUCINE	1277.5	
KETO-ISOLEUCINE	0.0	
LYSINE	43	
HISTIDINE	0	
THREONINE	1750	
HOMOSERINE	0.0	
METHIONINE	599.0	
CYSTEINE	*****	
HOMOCYSTEINE	0.0	
CYSTATHIONINE	0.0	
HOMOCYSTINE	0.0	
CYSTINE	0.0	
PHENYLALANINE	860.5	
TYROSINE	1398	
TRYPTOPHAN	183.5	

THIS SAMPLE CONTAINED 130.58 mg Creatinine/dL

*The numbers above are best used to make the qualitative judgement of normal versus abnormal and not for direct quantitative comparisons.

TABLE 22

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUTENTS
FRACTION V, BEAR URINE
JZ4081

CONCENTRATION: THIS SAMPLE CONTAINED 0.01 mM CREATININE/mL

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	CREAT NOT FOUND
7	10, STN031	1893	783	4.08	
19	16, 011031	1989	806	6.95	
34	31, NF3031	2090	757	0.78	
57	49, AK2011	2047	836	0.69	
66	SILANE, TRIMETHYLPHENOXY-	1122	887	2.82	
70	ETHYL AMINE DI-TMS	22	589	12.54	
77	PROPENE GLYCOL DI-TMS	50	867	0.84	
107	107, JZ4011	2301	787	0.79	
117	104, NJ3031	2131	860	12.78	
121	119, J04011	2243	922	1.09	
185	BETA-LACTATE DI-TMS	1654	773	2.17	
292	283, NF3091	2093	747	5.88	
361	TRIMETHYLSILYL ETHER OF GLYCEROL	273	917	0.77	
600	2-METHYL PROPANOATE GLYCINE CONJUGATE DI-TMS	226	904	0.88	
707	BUTYRIC ACID GLYCINE CONJUGATE DI-TMS	225	904	2.12	
805	METHYL D3 CREATININE TRI-TMS	1466	745	8.61	
825	BUTANEDIOIC ACID, OXO-TMS-, BIS-TMS- ESTER	401	698	0.68	
878	878	0	0	1.72	
940	940	0	0	0.80	
1076	CIS-ACONITIC ACID TRI-TMS	540	874	2.34	
1111	SALICYLIC ACID DI-TMS ORTHO-HYDROXY-BENZOIC	1720	286	3.95	
1135	1135, JZ4011	2306	865	1.88	
1223	VANILLYL MANDELIC ACID TRI-TMS	610	898	1.73	
1284	1284	0	0	1.01	
1364	1364, JZ4011	2312	888	1.05	
1594	1594	0	0	17.08	
1604	FROM GUAIFENESIN, 1813, NH3041	2169	688	6.27	
1788	1527, 0G1021	1987	631	1.79	

*The named compound matches the sample peak with a reliability given by "FIT"/1000

X1,0690

TABLE 23

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION VI, BEAR URINE
JZ4011:1

	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	2531	0-75
PYRUVIC ACID	516	0-20
GLYCOLIC ACID	53	0-50
ALPHA-OH-BUTYRIC	6.9	0-51
OXALIC	70.3	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	14.9	0-11
5-HYDROXYCAPROIC	0.0	0-1
OCTANOIC	0.0	0-1
BETA-LACTATE	29.4	0-8
SUCCINIC ACID	49	0-20
GLUTARIC ACID	272.8	0-2
2-OXO-GLUTARATE	26936	0-210
FUMARIC	24.1	0-5
MALEIC	0.0	0
MALIC ACID	1.5	0-2
ADIPIC ACID	3.7	0-7
SUBERIC ACID	5.7	0-11
SEBACIC ACID	0.0	0-2
GLYCERIC ACID	0	0-4
BETA-OH-BUTYRIC	55	0-3
METHYLSUCCINIC	8443.4	0
METHYLMALONIC	0	0-5
ETHYLMALONIC	0.0	0-4
HOMOGENTISIC ACID	25.6	0-1
PHENYLPYRUVIC ACID	7.7	0-1
SUCCINYLACETONE	2.6	0-1
3-OH-ISOVALERIC	0.6	0-21
PHOSPHATE	8	0-3000
CITRIC ACID	507	0-450
HIPPURIC ACID	472	0-2000
URIC ACID	218	0-360
Nutritionals		
KYNURENIC ACID	44.8	
FORMIMINOGLUTAMIC	0.00	0-3
4-PYRIDOXIC ACID	0.0	0-9
PANTOTHENIC ACID	0	0-30
XANTHURENIC ACID	0.0	0-1
KYNURENINE	0.0	0-1
QUINOLINIC	0.0	0-6
OROTIC ACID	0.00	0-3
D-AM LEVALINIC	1657.1	0-18
3-METHYL HISTIDINE	2	0-75
NIACINAMIDE	16.3	0-1
PSEUDOURIDINE	12665	10-220
2-DEOXYTETRONIC	0	0-75
P-HO-PHEN-ACETIC	5	0-12
XANTHINE	38	0-18
UROCANIC ACID	47	0-3
ASCORBIC ACID	0	0-160
GLYCEROL	705	0-9
Carbohydrates		
THREITOL	0	0-40
ERYTHRITOL	12	0-55
ARABINOSE	0	0-30
FUCOSE	0.4	0-12
RIBOSE	0.7	0-12
XYLOSE	0	0-70
FRUCTOSE	135	0-115
GLUCOSE	99	0-110
GALACTOSE	12	0-200
MANNOSE	54	0-70
N-AC-GLUCOSAMINE	2.7	0-3
LACTOSE	259	0-60
MALTOSE	127	0-40
XYLITOL	0.0	0-15

	mM/M CREATININE	Nrml Range
ARABINITOL	0.0	0-30
RIBITOL	0.0	0-10
ALLOSE	0.3	0-10
GLUCURONIC ACID	10.2	0-50
GALACTONIC ACID	15	0-60
GLUCONIC ACID	1.0	0-35
GLUCARIC	0.2	0-5
MANNITOL	10.2	0-15
DULCITOL	0.4	0-10
SORBITOL	9.7	0-10
INOSITOL	8.5	0-12
SUCROSE	1349	0-75
Neurotransmitters		
GABA	1.0	0-1
HOMOVANILLIC ACID	5.6	0-10
NORMETANEPHRINE	41.3	0-1
VANILLYLMANDELIC	90.3	0-6
METANEPHRINE	1.1	0-2
5-HIAA	1.2	0-6
MHPG	0.0	0-1
ETHANOLAMINE	409	10-90
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	0.0	0-1
BUTYRYL GLYCINE	1196.9	0-1
HEXANOYL GLYCINE	0.0	0-1
PHENYL PROP GLY	0.0	0-1
SUBERYL GLYCINE	0.0	0-1
ISOVALERYL GLY	0.0	0-1
TIGLY GLY	0.0	0-1
BETA MET CROT GLY	0.0	0-1
GLYCINE	1053	0-500
ALANINE	12	0-130
SARCOSINE	12.6	0-8
BETA-ALANINE	0.0	0-2
B-AMINOISOBUTYRIC	7	0-50
SERINE	1106	0-85
PROLINE	115.7	0-8
HYDROXY PROLINE	956	0-75
HYDROXY LYSINE	0.0	0-1
ASPARTIC ACID	232.4	0-2
ASPARAGINE	5.0	0-2
N-AC ASPARTIC	191.8	0-20
ORNITHINE	86.9	0-5
GLUTAMIC ACID	79.7	0-6
GLUTAMINE	4	0-210
PIPECOLIC ACID	0.0	0-1
LEUCINE	141.2	0-9
KETO LEUCINE	611.7	0-1
VALINE	272.9	0-18
KETO-VALINE	0.0	0-1
ISOLEUCINE	107.1	0-5
KETO-ISOLEUCINE	0.0	0-1
LYSINE	644	0-35
HISTIDINE	140	0-225
THREONINE	215	0-45
HOMOSERINE	0.0	0-1
METHIONINE	2.7	0-3
CYSTEINE	1122	0-160
HOMOCYSTEINE	0.0	0-1
CYSTATHIONINE	0.0	0-1
HOMOCYSTINE	0.0	0-1
CYSTINE	8.7	0-5
PHENYLALANINE	85	0-20
TYROSINE	68	0-22
TRYPTOPHAN	54	0-25

This sample contained 0.02 uMoles Creatinine/1.00ml.

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KT,0700

TABLE 24

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION VI, BEAR URINE
JZ4011

CONCENTRATION: THIS SAMPLE CONTAINED 0.02 uM CREATININE/ml

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT VS 1000	AREA %	AREA% OF CREAT
5	6,J14081	2189	780	1.67	422.70
8	10,STN031	1893	857	2.71	684.47
20	16,0I1031	1989	820	5.76	1454.73
35	35	0	0	0.75	190.42
58	49, AK2011	2047	835	0.52	132.24
67	SILANE, TRIMETHYLPHENOXY-	1122	932	2.18	551.58
73	1,3 PROPANEDIOL DI-TMS	1675	934	5.38	1358.88
78	LACTIC ACID DI-TMS	1510	927	0.74	187.43
107	107	0	0	0.59	148.59
118	104, NJ3031	2131	884	8.05	2032.64
122	119, J14011	2243	925	0.82	206.86
134	BLYCINE DI-TMS	51	822	0.25	64.34
186	BETA-LACTATE DI-TMS	1654	755	1.55	391.09
251	251	0	0	0.38	95.36
294	UREA DI-TMS	37	800	3.00	757.29
362	TRIMETHYLSILYL ETHER OF GLYCEROL	273	904	1.33	336.55
383	OCTANOIC ACID, 2-0S0-, TRIMETHYLSILYL ESTER	72	707	0.27	69.11
427	METHYLSUCCINIC ACID DI-TMS	173	948	3.17	799.71
502	SERINE TRI-TMS	322	958	0.51	128.24
697	3-METHYL-2-PENTENEDIOIC ACID DI-TMS	2004	619	0.31	77.45
706	BUTYRIC ACID GLYCINE CONJUGATE DI-TMS	225	874	0.43	107.51
748	HYDROXY PROLINE DI-TMS	156	938	0.39	99.20
808	METHYL D3 CREATININE TRI-TMS	1466	705	12.91	3258.96
825	BUTANEDIOIC ACID, OXO-TMS-, BIS-TMS-ESTER	401	704	0.26	66.23
828	828	0	0	0.42	105.07
894	PENTANEDIOIC ACID, 3-OXO-, TRIS-TMS ESTER	448	923	0.46	116.34
901	PARA HYDROXY BENZOIC DI=TMS	202	912	0.38	95.59
964	964	0	0	1.16	293.82
1013	1013	0	0	0.39	97.24
1078	CIS-ACONITIC ACID TRI-TMS	540	839	6.15	1152.41
1111	P-HO PHENYL GLYCOLIC TRI-TMS	532	927	2.98	753.39
1135	1135	0	0	0.70	175.75
1141	1141	0	0	1.39	351.33
1167	CITRIC ACID TETRA-TMS	774	870	0.67	169.16
1192	1192	0	0	1.20	302.08
1215	1215	0	0	0.40	101.36
1223	1223	0	0	0.28	69.72
1252	1252	0	0	0.78	197.12
1364	1364	0	0	0.30	76.77
1370	PALMITIC ACID TMS	335	821	0.24	60.76
1389	289, ND3031	2073	678	1.49	377.32
1417	PENTANEDIOIC ACID, 3,3-DIMETHYL-, BIS-TMS-EST	260	418	0.50	125.53
1427	1427	0	0	0.55	138.13
1443	URIC ACID TETRA-TMS	1505	780	0.25	61.93
1462	1462	0	0	1.15	291.01
1492	PARA-HYDROXYPHENYLACETIC GLYCINE CONJ TR	2299	991	7.19	1816.50
1500	1481, NU3091	2124	782	8.74	2207.43
1596	PSEUDO URIDINE PENTA-TMS	1779	768	8.67	2189.48
1628	1472, VST031	2031	737	0.25	63.50
1746	SUCROSE OCTA-TMS	1080	924	1.05	265.38

* The named compound matches the sample peak with a reliability given by "FIT"/1000

TABLE 25

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION VII, BEAR URINE
JZ4021:2

	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	2166	0-75
PYRUVIC ACID	211	0-20
GLYCOLIC ACID	24	0-50
ALPHA-OH-BUTYRIC	3.7	0-1
OXALIC	0.0	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	7.4	0-11
5-HYDROXYCAPROIC	0.0	0-1
OCTANOIC	0.0	0-1
BETA-LACTATE	10.3	0-8
SUCCINIC ACID	7	0-20
GLUTARIC ACID	0.0	0-2
2-OXO-GLUTARATE	0	0-210
FUMARIC	6.4	0-5
MALEIC	0.0	0
MALIC ACID	0.0	0-2
ADIPIC ACID	55.2	0-7
SUBERIC ACID	0.0	0-11
SEBACIC ACID	0.0	0-2
GLYCERIC ACID	0	0-4
BETA-OH-BUTYRIC	15	0-3
METHYLSUCCINIC	2082.5	0
METHYLMALONIC	0	0-5
ETHYLMALONIC	1711.8	0-4
HOMOGENTISIC ACID	14.6	0-1
PHENYLPYRUVIC ACID	3.4	0-1
SUCCINYLACETONE	10.4	0-1
3-OH-ISOVALERIC	0.6	0-21
PHOSPHATE	208	0-3000
CITRIC ACID	58	0-450
HIPPURIC ACID	48	0-2000
URIC ACID	3	0-360
Nutritionals		
KYNURENIC ACID	0.0	
FORMIMINOGLUTAMIC	0.00	0-3
4-PYRIDOXIC ACID	0.0	0-9
PANTOTHENIC ACID	0	0-30
XANTHURENIC ACID	0.0	0-1
KYNURENINE	4.8	0-1
QUINOLINIC	0.0	0-6
OROTIC ACID	0.00	0-3
D-AM LEVULINIC	274.3	0-18
3-METHYL HISTIDINE	0	0-75
NIACINAMIDE	0.0	0-1
PSEUDOURIDINE	8927	10-220
2-DEOXYTETRONIC	0	0-75
P-HO-PHEN-ACETIC	9	0-12
XANTHINE	0	0-18
UROCANIC ACID	11	0-3
ASCORBIC ACID	0	0-160
GLYCEROL	470	0-9
Neurotransmitters		
GABA	0.0	0-1
HOMOVANILLIC ACID	91.0	0-10
NORMETANEPHRINE	0.7	0-1
VANILLYLMANDELIC	0.4	0-6
METANEPHRINE	0.4	0-2
5-HIAA	3.2	0-6
MHPG	0.0	0-1
ETHANOLAMINE	218	10-90
Carbohydrates		
THREITOL	0	0-40
ERYTHRITOL	4	0-55
ARABINOSE	0	0-30
FRUCTOSE	0.0	0-12
FUCOSE	0.0	0-12
RIBOSE	0	0-70
XYLOSE	71	0-115

	mM/M CREATININE	Nrml Range
GLUCOSE	101	0-110
GALACTOSE	1	0-200
MANNOSE	36	0-70
N-AC-GLUCOSAMINE	0.9	0-3
LACTOSE	107	0-60
MALTOSE	61	0-40
XYLITOL	0.0	0-15
ARABINITOL	0.0	0-30
RIBITOL	0.0	0-10
ALLOSE	0.0	0-10
GLUCURONIC ACID	35.8	0-50
GALACTONIC ACID	10	0-60
GLUCONIC ACID	4.5	0-35
GLUCARIC	0.0	0-5
MANNITOL	12.7	0-15
DULCITOL	1.0	0-10
SORBITOL	12.7	0-10
INOSITOL	2.0	0-12
SUCROSE	577	0-75
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	0.0	0-1
BUTYRYL GLYCINE	0.0	0-1
HEXANOL GLYCINE	0.0	0-1
PHENYL PROP GLY	0.0	0-1
SUBERYL GLYCINE	0.0	0-1
ISOVALERYL GLY	279.7	0-1
TIGLY GLY	53.2	0-1
BETA MET CROT GLY	0.0	0-1
GLYCINE	584	0-500
ALANINE	437	0-130
SARCOSINE	5.2	0-8
BETA-ALANINE	0.0	0-2
B-AMINOISOBUTYRIC	2	0-50
SERINE	675	0-85
PROLINE	55.3	0-8
HYDROXY PROLINE	386	0-75
HYDROXY LYSINE	0.0	0-1
ASPARTIC ACID	96.5	0-2
ASPARAGINE	0.0	0-2
N-AC ASPARTIC	10.3	0-20
ORNITHINE	55.4	0-5
GLUTAMIC ACID	20.1	0-6
GLUTAMINE	0	0-210
PIPECOLIC ACID	0.0	0-1
LEUCINE	54.5	0-9
KETO LEUCINE	64.7	0-1
VALINE	112.8	0-18
KETO-VALINE	0.0	0-1
ISOLEUCINE	41.7	0-5
KETO-ISOLEUCINE	0.0	0-1
LYSINE	14	0-35
HISTIDINE	5	0-225
THREONINE	96	0-45
HOMOSERINE	0.0	0-1
METHIONINE	32.3	0-3
CYSTEINE	713	0-160
HOMECYSTEINE	0.0	0-1
CYSTATHIONINE	0.0	0-1
HOMOCYSTINE	0.0	0-1
CYSTINE	0.0	0-5
PHENYLALANINE	19	0-20
TYROSINE	23	0-22
TRYPTOPHAN	8	0-25

This sample contained 0.02 uMoles Creatinine/1.00ml.

TABLE 26

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION VII, BEAR URINE
JZ4021

CONCENTRATION: THIS SAMPLE CONTAINED 0.02 mM CREATININE/mL

PEAK	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs1000	AREA %	AREA OF CREAT
8	10, STNO31	1893	854	4.82	564.34
20	16, 0I1031	1989	819	6.98	817.58
35	35, JZ4011	2300	945	0.97	113.26
58	49, AK2011	2047	821	0.68	79.19
67	SILANE, TRIMETHYLPHENOXY-	1122	935	2.89	338.68
73	1, 3 PROPANEDIOL DI-TMS	1675	931	6.05	708.72
78	LACTIC ACID DI-TMS	1510	931	1.23	144.38
108	107, JZ4011	2301	889	0.78	91.61
118	104, NJ3031	2131	880	11.50	1346.76
122	119, JQ4011	2243	920	1.13	131.83
186	BETA-LACTATE DI-TMS	1654	769	2.12	248.66
190	2-METHYL 2-HYDROXY BUTYRIC ACID DI-TMS	140	887	0.43	50.10
292	UREA DI-TMS	37	813	2.61	305.69
362	TRIMETHYLSILYL ETHER OF GLYCEROL	273	913	1.73	202.95
427	METHYLSUCCINIC ACID DI-TMS	173	943	1.52	178.04
501	501	0	0	1.45	170.19
697	697	0	0	1.05	123.17
750	697, JZ4021	2316	603	0.65	76.67
809	METHYL D3 CREATININE TRI-TMS	1466	683	26.41	3094.26
848	848	0	0	0.52	60.54
985	985	0	0	0.72	84.59
1239	P-HYDROXYPHENYL LACTIC ACID TRI-TMS	578	957	5.50	644.36
1496	1481, NU3091	2124	753	0.48	56.26
1596	PSEUDO URIDINE PENTA-TMS	1779	783	9.00	1054.48
1642	1631, M15041	1802	789	9.19	1076.96
1689	1689	0	0	0.58	67.59
1741	TREHALOSE PER-TMS	1850	773	2.86	335.16
1746	SUCROSE OCTA-TMS	1080	923	0.97	113.28

* The named compound matches the sample peak with a reliability given by "FIT"/1000.

Isolated compounds obtained from GC/MS were then compared to a database of chemical mass spectra for identification. Tables 21, 23, and 25 list the identified organic acids, nutritionals, carbohydrates, neurotransmitters, amino acids, and glycine conjugates of Fractions V, VI, and VII respectively.

Tables 22, 24, and 26 list peaks found in Fractions V, VI, and VII. The peaks are identified by retention time and correlated with the "best match" identified from the database library. Values of 700 or higher (1000 represents a perfect match) are considered indicative of substance identification. Peaks identified solely by a special number (peak #7 in Table 22 of Fraction V) indicate that this particular substance has been previously identified but that its chemical structure is unknown. When the peak number and the "best match from the library" are the same (as for peaks 878, 940, 1284, and 1594 in Table 22), it is an indication that these substances have not been identified by previous users of the database library. Similar data for Fractions I, II, IV, VIII, IX and X are in the following Tables 27 through 38.

BHB is found mainly in Fraction IV; MNC is found in Fractions V and VI. The most potent stimulators of osteoblast activity are found in Fractions V, VI, and VII.

<u>Summary</u>

1. Separation techniques of BDI have been refined. BDI has been separated into ten small fractions. Fractions V, VI, and VII of BDI contain substances that produce the most potent stimulation of osteoblasts. The substances that most strongly inhibit osteoblast function are found in Fraction III of BDI.

2. MNC is found in two fractions of BDI that produce the most potent stimulation of osteoblasts - Fractions V and Fraction VI. Preliminary data suggest that one or more components of MNC are found in Fraction VII.

3. The presence of known and unknown substances contained in all ten fractions has been recorded by GC/MS.

17,0740

TABLE 27

QUANTIFIED TARGET PANEL
METABOLIC SCREENING LABORATORY
FRACTION I, BEAR URINE
JZ4041:3

	uM/L*	Nrml Range
Organic Acids		
LACTIC ACID	283233	
PYRUVIC ACID	8387	
GLYCOLIC ACID	1032	
ALPHA-OH-BUTYRIC	19.5	
OXALIC	0.0	
4-OH-BUTYRIC	0.0	
HEXANOIC ACID	227.5	
5-HYDROXYCAPROIC	0.0	
OCTANOIC	0.0	
BETA-LACTATE	674.0	
SUCCINIC ACID	0	
GLUTARIC ACID	0.0	
2-OXO-GLUTARATE	0.0	
FUMARIC	35.0	
MALEIC	0.0	
MALIC ACID	0.0	
ADIPIC ACID	49.5	
SUBERIC ACID	47.5	
SEBACIC ACID	0.0	
GLYCERIC ACID	0.0	
BETA-OH-BUTYRIC	2075.5	
METHYLSUCCINIC	0.0	
METHYLMALONIC	0.0	
ETHYLMALONI	0.0	
HOMOGENTISIC ACID	0.0	
PHENYLPYRUVIC ACID	0.0	
SUCCINYLACETONE	0.0	
3-OH-ISOVALERIC	0.0	
PHOSPHATE	3.71	mg/dL
CITRIC ACID	61	
HIPPURIC ACID	0	
URIC ACID	1.20	mg/dL
Nutritionals		
FORMIMINOGLUTAMIC	0.00	
4-PYRIDOXIC ACID	0.0	
PANTOTHENIC ACID	0.0	
XANTHURENIC ACID	0.0	
KYNURENINE	0.0	
QUINOLINIC	0.0	
7OROTIC ACID	0.0	
D-AM LEVULINIC	********	
3-METHYL HISTIDINE	0.00	
NIACINAMIDE	0.0	
PSEUDOURIDINE	221791	
2-DEOXYTETRONIC	0	
P-HO-PHEN-ACETIC	10	
XANTHINE	0	
UROCANIC ACID	96	
ASCORBIC ACID	0	
GLYCEROL	5903.5	

	uM/L*	Nrml Range
Carbohydrates		
THREITOL	0	
ERYTHRITOL	27	
ARABINOSE	0	
FUCOSE	0.0	
RIBOSE	0.0	
XYLOSE	13	
FRUCTOSE	1067	
GLUCOSE	35	
mg/dLGALACTOSE	104	
MANNOSE	988	
N-AC-GLUCOSAMINE	0.0	
LACTOSE	2921	
MALTOSE	2684	
XYLITOL	0.0	
ARABINITOL	0.0	
RIBITOL	0.0	
ALLOSE	0.0	
GLUCURONIC ACID	0.0	
GALACTONIC ACID	440	
GLUCONIC ACID	0.0	
CLUCARIC	0.0	
MANNITOL	681.5	
DULCITOL	91.0	
SORBITOL	681.0	
INOSITOL	107.0	
SUCROSE	12380	
Neurotransmitters		
GABA	89.5	
HOMOVANILLIC ACID	0.0	
NORMETANEPHRINE	0.0	
VANILLYLMANDELIC	0.0	
METANEPHRINE	0.0	
5-HIAA	0.0	
MHPG	0.0	
ETHANOLAMINE	4416	
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	0.0	
BUTYRYL GLYCINE	0.0	
HEXANOL GLYCINE	0.0	
PHENYL PROP GLY	0.0	
SUBERYL GLYCINE	0.0	
ISOVALERYL GLY	0.0	
TIGLY GLY	0.0	
BETA MET CROT GLY	0.0	
GLYCINE	10411	
ALANINE	93	
SARCOSINE	108.0	
BETA-ALANINE	0.0	
B-AMINOISOBUTYRIC	0	
SERINE	10329	
PROLINE	1125.5	
HYDROXY PROLINE	10671	

Table 27, cont.

QUANTIFIED TARGET PANEL
METABOLIC SCREENING LABORATORY
FRACTION I, BEAR URINE
JZ4041: 3

	uM/L*	Nrml Range
HYDROXY LYSINE	0.0	
ASPARTIC ACID	1012.0	
ASPARAGINE	27.0	
N-AC ASPARTIC	116.0	
ORNITHINE	390.0	
GLUTAMIC ACID	343.5	
GLUTAMINE	0	
PIPECOLIC ACID	0.0	
LEUCINE	1342.0	
KETO LEUCINE	2776.0	
VALINE	2256.0	
KETO-VALINE	0.0	
ISOLEUCINE	985.0	
KETO-ISOLEUCINE	0.0	
LYSINE	63	
HISTIDINE	0	
THREONINE	771	
HOMOSERINE	0.0	
METHIONINE	0.0	
CYSTEINE	3314.5	
HOMECYSTEINE	0.0	
CYSTATHIONINE	0.0	
HOMOCYSTINE	0.0	
CYSTINE	0.0	
PHENYLALANINE	308.5	
TYROSINE	370	
TRYPTOPHAN	28.0	

This sample contained 7.61 mg Creatinine/dL.

TABLE 28

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION I, BEAR URINE
JZ4041

CONCENTRATION: THIS SAMPLE CONTAINED 0.00 uM CREATININE/mL

PEAK	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA % OF CREAT
9	10, STN031	1893	849	12.44	50748.26
20	10, M13011	1782	755	12.97	52898.66
35	35, JZ4011	2300	942	1.24	5069.15
58	49, AK2011	2047	804	1.01	4129.25
67	SILANE, TRIMETHYLPHENOXY-	1122	934	3.83	15642.15
72	ETHYL AMINE DI-TMS	22	546	12.80	52202.81
79	LACTIC ACID DI-TMS	1510	959	7.49	30555.24
108	107, JZ4011	2301	939	0.99	4047.10
118	104, NJ3031	2131	882	16.86	68779.39
122	119, JQ4011	2243	930	1.60	6511.24
186	BETA-LACTATE DI-TMS	1654	770	2.91	11857.41
288	UREA DI-TMS	37	816	0.90	3654.45
361	TRIMETHYLSILYL ETHER OF GLYCEROL	273	911	1.17	4787.66
539	539	0	0	0 .65	2647.54
807	METHYL D3 CREATININE TRI-TMS	1466	706	18.22	74308.42
1370	PALMITIC ACID TMS	335	857	0.92	3734.21
1519	STEARIC ACID TMS	434	870	0.70	2849.90
1595	PSEUDO URIDINE PENTA-TMS	1779	750	13.13	53567.98
1672	1669, P17031	1984	908	1.15	4703.70
1745	SUCROSE OCTA-TMS	1080	912	1.46	5942.59

*The named compound matches the sample peak with a reliability given by "FIT"/1000.

TABLE 29

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION II, BEAR URINE
JZ4051:4

	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	94	0-75
PYRUVIC ACID	6	0-20
GLYCOLIC ACID	2	0-50
ALPHA-OH-BUTYRIC	0.1	0-1
OXALIC	0.0	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	0.0	0-11
5-HYDROXYCAPROIC	0.0	0-1
OCTANOIC	0.0	0-1
BETA-LACTATE	0.0	0-8
SUCCINIC ACID	3	0-20
GLUTARIC ACID	0.0	0-2
2-OXO-GLUTARATE	0	0-210
FUMARIC	0.0	0-5
MALEIC	0.0	0
MALIC ACID	0.0	0-2
ADIPIC ACID	0.0	0-7
SUBERIC ACID	0.0	0-11
SEBACIC ACID	0.0	0-2
GLYCERIC ACID	0	0-4
BETA-OH-BUTYRIC	1	0-3
METHYLSUCCINIC	0.0	0
METHYLMALONIC	0	0-5
ETHYLMALONI	0.0	0-4
HOMOGENTISIC ACID	0.0	0-1
PHENYLPYRUVIC ACID	0.7	0-1
SUCCINYLACETONE	0.0	0-1
3-OH-ISOVALERIC	0.0	0-21
PHOSPHATE	137	0-3000
CITRIC ACID	0	0-450
HIPPURIC ACID	13	0-2000
URIC ACID	0	0-360
Nutritionals		
KYNURENIC ACID	0.0	
FORMIMINOGLUTAMIC	0.00	0-3
4-PYRIDOXIC ACID	0.0	0-9
PANTOTHENIC ACID	0	0-30
XANTHURENIC ACID	0.0	0-1
KYNURENINE	0.0	0-1
QUINOLINIC	0.0	0-6
OROTIC ACID	0.00	0-3
D-AM LEVULINIC	1.0	0-18
3-METHYL HISTIDINE	7	0-75
NIACINAMIDE	0.0	0-1
PSEUDOURIDINE	170	10-220
2-DEOXYTETRONIC	0	0-75
P-HO-PHEN-ACETIC	5	0-12
XANTHINE	0	0-18
UROCANIC ACID	0	0-3
ASCORBIC ACID	0	0-160
GLYCEROL	3	0-9

	mM/M CREATININE	Nrml Range
Carbohydrates		
THREITOL	1	0-40
ERYTHRITOL	5	0-55
ARABINOSE	0	0-30
FUCOSE	0.0	0-12
RIBOSE	0.0	0-12
XYLOSE	0	0-70
FRUCTOSE	0	0-115
GLUCOSE	2	0-110
GALACTOSE	0	0-200
MANNOSE	0	0-70
N-AC-GLUCOSAMINE	0.0	0-3
LACTOSE	1	0-60
MALTOSE	1	0-40
XYLITOL	0.9	0-15
ARABINITOL	0.0	0-30
RIBITOL	0.0	0-10
ALLOSE	0.4	0-10
GLUCURONIC ACID	0.0	0-50
GALACTONIC ACID	0	0-60
GLUCONIC ACID	0.0	0-35
CLUCARIC	0.0	0-5
MANNITOL	0.1	0-15
DULCITOL	0.1	0-10
SORBITOL	0.9	0-10
INOSITOL	0.1	0-12
SUCROSE	4	0-75
Neurotransmitters		
GABA	0.0	0-1
HOMOVANILLIC ACID	1.1	0-10
NORMETANEPHRINE	0.0	0-1
VANILLYLMANDELIC	0.0	0-6
METANEPHRINE	0.2	0-2
5-HIAA	1.9	0-6
MHPG	0.0	0-1
ETHANOLAMINE	6	10-90
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	0.0	0-1
BUTYRYL GLYCINE	0.0	0-1
HEXANOL GLYCINE	0.0	0-1
PHENYL PROP GLY	0.0	0-1
SUBERYL GLYCINE	0.0	0-1
ISOVALERYL GLY	0.0	0-1
TIGLY GLY	0.0	0-1
BETA MET CROT GLY	0.0	0-1
GLYCINE	10	0-500
ALANINE	0	0-130
SARCOSINE	0.2	0-8
BETA-ALANINE	0.0	0-2
B-AMINOISOBUTYRIC	0	0-50
SERINE	9	0-85
PROLINE	0.7	0-8
HYDROXY PROLINE	13	0-75

TABLE 29, Page 2
QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION II, BEAR URINE
JZ4051:4

	mM/M CREATININE	Nrml Range
HYDROXY LYSINE	0.0	0-1
ASPARTIC ACID	0.6	0-2
ASPARAGINE	0.0	0-2
N-AC ASPARTIC	0.0	0-20
ORNITHINE	0.1	0-5
GLUTAMIC ACID	0.5	0-6
GLUTAMINE	0	0-210
PIPECOLIC ACID	0.0	0-1
LEUCINE	0.9	0-9
KETO LEUCINE	13.4	0-1
VALINE	1.6	0-18
KETO-VALINE	0.0	0-1
ISOLEUCINE	0.5	0-5
KETO-ISOLEUCINE	0.0	0-1
LYSINE	4	0-35
HISTIDINE	0	0-225
THREONINE	0	0-45
HOMOSERINE	0.0	0-1
METHIONINE	0.0	0-3
CYSTEINE	9	0-160
HOMOCYSTEINE	0.0	0-1
CYSTATHIONINE	0.0	0-1
HOMOCYSTINE	0.0	0-1
CYSTINE	0.0	0-5
PHENYLALANINE	0	0-20
TYROSINE	0	0-22
TRYPTOPHAN	0	0-25

This sample contained 0.42 uMoles Creatinine/1.00ml.

85,0790

TABLE 30

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION II, BEAR URINE
JZ4051

CONCENTRATION: THIS SAMPLE CONTAINED 0.42 uM CREATININE/mL

PEAK	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA % OF CREAT
6	10, STN031	1893	823	2.11	13.22
13	13	0	0	0.53	3.32
18	16, OI1031	1989	785	6.94	43.44
33	35, JZ4011	2300	882	0.59	3.70
56	49, AK2011	2047	831	0.51	3.19
65	SILANE, TRIMETHYLPHENOXY-	1122	935	1.87	11.73
69	ETHYL AMINE DI-TMS	22	581	5.56	34.84
76	LACTIC ACID DI-TMS	1510	946	1.02	6.42
106	107, JZ4011	2301	785	0.58	3.62
116	104, NJ3031	2131	866	9.15	57.29
120	119, JQ4011	2243	913	0.75	4.71
184	BETA-LACTATE DI-TMS	1654	764	1.45	9.07
250	251, JZ4011	2302	923	0.47	2.97
282	UREA DI-TMS	37	721	0.83	5.23
308	283 NF3091	2093	745	18.17	113.79
354	PHOSPHATE TRI-TMS	1413	905	3.37	21.13
537	539 JZ4041	2320	956	0.56	3.53
810	CREATININE TRI-TMS	1784	946	35.05	219.48
846	3-PHENYL LACTIC TMS 2	1562	677	0.43	2.70
916	PARA-HYDROXYPHENYLACETIC ACID DI-TMS	1485	938	0.64	3.99
1189	1189	0	0	0.59	3.70
1204	1189, NU3061	2118	711	1.81	11.34
1230	MOUSE HORMONE?	1508	712	0.39	2.44
1234	1234, JD2031	2002	789	0.85	5.32
1261	STEROID M	1509	788	0.73	4.60
1369	PALMITIC ACID TMS	335	862	1.00	6.25
1519	STEARIC ACID TMS	434	918	0.38	2.38
1594	PSEUDO URIDINE PENTA-TMS	1779	816	5.75	36.03

*The named compound matches the sample peak with a reliability given by "FIT"/1000.

87,0800

TABLE 31

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION IV, BEAR URINE
JZ4071:6

	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	2393	0-75
PYRUVIC ACID	15	0-20
GLYCOLIC ACID	4	0-50
ALPHA-OH-BUTYRIC	0.7	0-1
OXALIC	0.0	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	28.1	0-11
5-HYDROXYCAPROIC	0.0	0-1
OCTANOIC	0.0	0-1
BETA-LACTATE	19.9	0-8
SUCCINIC ACID	1916	0-20
GLUTARIC ACID	0.0	0-2
2-OXO-GLUTARATE	210	0-210
FUMARIC	1.7	0-5
MALEIC	25.6	0
MALIC ACID	39.4	0-2
ADIPIC ACID	0.9	0-7
SUBERIC ACID	0.2	0-11
SEBACIC ACID	1.6	0-2
GLYCERIC ACID	0	0-4
BETA-OH-BUTYRIC	5822	0-3
METHYLSUCCINIC	0.0	0
METHYLMALONIC	0	0-5
ETHYLMALONIC	0.0	0-4
HOMOGENTISIC ACID	0.0	0-1
PHENYLPYRUVIC ACID	1163.4	0-1
SUCCINYLACETONE	1.0	0-1
3-OH-ISOVALERIC	2.1	0-21
PHOSPHATE	135	0-3000
CITRIC ACID	8	0-450
HIPPURIC ACID	25	0-2000
URIC ACID	2	0-360
Nutritionals		
KYNURENIC ACID	13.8	
FORMIMINOGLUTAMIC	16.80	0-3
4-PYRIDOXIC ACID	60.5	0-9
PANTOTHENIC ACID	20	0-30
XANTHURENIC ACID	0.0	0-1
KYNURENINE	3.2	0-1
QUINOLINIC	37.4	0-6
OROTIC ACID	0.00	0-3
D-AM LEVULINIC	30.8	0-18
3-METHYL HISTIDINE	9	0-75
NIACINAMIDE	12.7	0-1
PSEUDOURIDINE	19	10-220
2-DEOXYTETRONIC	2	0-75
P-HO-PHEN-ACETIC	2	0-12
XANTHINE	0	0-18
UROCANIC ACID	1	0-3
ASCORBIC ACID	3	0-160
GLYCEROL	36	0-9

	mM/M CREATININE	Nrml Range
Carbohydrates		
THREITOL	0	0-40
ERYTHRITOL	2	0-55
ARABINOSE	0	0-30
FUCOSE	1.4	0-12
RIBOSE	1.0	0-12
XYLOSE	2	0-70
FRUCTOSE	0	0-115
GLUCOSE	55	0-110
GALACTOSE	7	0-200
MANNOSE	1	0-70
N-AC-GLUCOSAMINE	0.3	0-3
LACTOSE	11	0-60
MALTOSE	11	0-40
XYLITOL	0.0	0-15
ARABINITOL	0.0	0-30
RIBITOL	0.0	0-10
ALLOSE	0.8	0-10
GLUCURONIC ACID	11.8	0-50
GALACTONIC ACID	166	0-60
GLUCONIC ACID	0.0	0-35
CLUCARIC	0.0	0-5
MANNITOL	1.2	0-15
DULCITOL	0.0	0-10
SORBITOL	1.2	0-10
INOSITOL	0.0	0-12
SUCROSE	14	0-75
Neurotransmitters		
GABA	4.2	0-1
HOMOVANILLIC ACID	2.0	0-10
NORMETANEPHRINE	20.2	0-1
VANILLYLMANDELIC	2.0	0-6
METANEPHRINE	0.5	0-2
5-HIAA	5.0	0-6
MHPG	2.7	0-1
ETHANOLAMINE	17	10-90
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	322.6	0-1
BUTYRYL GLYCINE	0.4	0-1
HEXANOYL GLYCINE	0.0	0-1
PHENYL PROP GLY	0.0	0-1
SUBERYL GLYCINE	0.0	0-1
ISOVALERYL GLY	35.7	0-1
TIGLY GLY	18.7	0-1
BETA MET CROT GLY	150.5	0-1
GLYCINE	82	0-500
ALANINE	50	0-130
SARCOSINE	0.3	0-8
BETA-ALANINE	0.0	0-2
B-AMINOISOBUTYRIC	39	0-50
SERINE	54	0-85
PROLINE	4.8	0-8

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TABLE 31, cont.

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION IV, BEAR URINE
JZ4071: 6

	mM/M CREATININE	Nrml Range
HYDROXY PROLINE	92	0-75
HYDROXY LYSINE	0.0	0-1
ASPARTIC ACID	14.0	0-2
ASPARAGINE	0.3	0-2
N-AC ASPARTIC	5.0	0-20
ORNITHINE	12.0	0-5
GLUTAMIC ACID	2.4	0-6
GLUTAMINE	46	0-210
PIPECOLIC ACID	0.0	0-1
LEUCINE	47.4	0-9
KETO LEUCINE	45.3	0-1
VALINE	9.1	0-18
KETO-VALINE	0.0	0-1
ISOLEUCINE	6.3	0-5
KETO-ISOLEUCINE	0.0	0-1
LYSINE	45	0-35
HISTIDINE	9	0-225
THREONINE	6	0-45
HOMOSERINE	2.2	0-1
METHIONINE	0.0	0-3
CYSTEINE	179	0-160
HOMECYSTEINE	0.0	0-1
CYSTATHIONINE	1.2	0-1
HOMOCYSTINE	0.0	0-1
CYSTINE	0.3	0-5
PHENYLALANINE	3	0-20
TYROSINE	5	0-22
TRYPTOPHAN	238	0-25

This sample contained 0.42 uMoles Creatine/1.00ml.

KT, 0820

TABLE 32

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION IV, BEAR URINE
JZ4071

CONCENTRATION: THIS SAMPLE CONTAINED 0.23 uM CREATININE/mL

PEAK	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA % OF CREAT
20	10, M13011	1782	716	1.28	48.98
28	10, M13011	1782	821	1.18	45.14
34	35, JZ4011	2300	836	0.25	9.56
57	49, AK2011	2047	814	0.20	7.79
66	SILANE, TRIMETHYLPHENOXY-	1122	879	0.80	30.66
71	ETHYL AMINE DI-TMS	22	529	2.92	111.91
78	LACTIC ACID DI-TMS	1510	927	4.23	162.24
107	107, JZ4011	2301	865	0.25	9.47
117	104, NJ3031	2131	872	4.13	158.52
122	119, JQ4011	2243	902	0.34	13.19
187	BETA HYDROXYBUTYRIC ACID DI-TMS	1622	930	14.85	569.62
251	251, JZ4011	2302	928	0.29	10.98
283	4-HYDROXY BUTYRIC ACID DI-TMS	97	724	0.16	6.05
293	283, NF3091	2093	745	0.25	9.61
305	283, NF3091	2093	744	1.83	70.32
355	PHOSPHATE TRI-TMS	1413	898	0.43	16.33
361	TRIMETHYLSILYL ETHER OF GLYCEROL	273	882	0.63	24.21
407	SUCCINIC ACID DI-TMS	1635	892	5.26	201.56
599	PROPIONATE GLYCINE CONJUGATE DI-TMS	165	961	1.11	42.71
611	564, JJ4021	2200	742	0.28	10.77
689	CITRAMALIC ACID TRI-TMS, 675	2103	944	0.40	15.18
722	NORLEUCINE DI-TMS	1540	656	2.48	95.07
749	749	0	0	1.11	42.72
797	259, 192 TMS	1470	367	0.27	10.23
808	CREATININE TRI-TMS	1784	913	8.32	319.11
845	845	0	0	0.19	7.28
862	862	0	0	0.18	6.77
940	GLYCOLIC ACID DI-TMS	55	405	0.35	13.32
978	251, JZ4011	2302	390	0.16	6.22
985	985	0	0	2.58	98.95
997	996, GI1021	1958	790	0.24	9.35
1000	1000	0	0	0.25	9.60
1011	.BETA. PHENYLPYRUVIC ACID DI-TMS	280	887	3.95	151.29
1027	1027	0	0	0.93	35.63
1037	1037	0	0	0.41	15.72
1047	1047	0	0	0.19	7.19
1064	2-HYDROXY BENZAMIDE DI-TMS	198	421	0.51	19.63
1071	1071	0	0	0.22	8.29
1079	CIS-ACONITIC ACID TRI-TMS	540	792	6.66	255.42
1093	L-GLUTAMIC ACID, N-ACETYL-N-TMS, BIS-TMS EST	587	665	0.25	9.43
1098	862, JZ4071	2344	665	0.43	16.53
1103	1103	0	0	0.52	19.81
1114	1114	0	0	0.31	12.01
1120	1071, JZ4071	2350	685	0.64	24.48
1135	1135, JZ4011	2306	868	0.57	22.01
1178	1178	0	0	0.16	6.31
1183	6-AMINO HEXANOIC ACID DI-TMS	166	537	0.41	15.79
1196	QUINOLINIC TMS 2	1564	481	1.31	50.20
1202	1202	0	0	0.55	21.09
1228	1228	0	0	4.38	167.97
1237	1, 6 DIHYDRO 1-METHYL 6-OXO 3-PYRIDINECARBOXAM	63	558	4.31	165.39

Table 32, cont.

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION IV, BEAR URINE
JZ4071

PEAK	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA % OF CREAT
1253	MANNOSE PENTA-TMS	879	901	0.28	10.68
1277	4-PYRIDOXIC ACID TRI-TMS	580	697	0.37	14.00
1294	NORVALINE DI-TMS	128	402	0.75	28.82
1300	1300	0	0	0.39	14.89
1310	NORVALINE DI-TMS	128	432	0.25	9.50
1346	P-HO PHENYL GLYCOLIC TRI-TMS	532	735	0.17	6.61
1354	MANNOSE PENTA-TMS	879	913	0.38	14.67
1382	1382	0	0	0.64	24.60
1386	GLYCINE DI-TMS	51	477	0.18	6.93
1397	1217, NC1031	1992	543	0.16	6.32
1435	1435	0	0	0.20	7.49
1443	URIC ACID TETRA-TMS	1505	674	0.33	12.63
1510	TRYPTOPHAN TRI-TMS	1965	825	2.01	77.00
1515	1515	0	0	0.99	37.86
1545	1545	0	0	0.17	6.59
1589	1-PHENYL 2-AMINO PROPANE DI-TMS	190	712	0.16	5.96
1595	PSEUSO URIDINE PENTA-TMS	1779	945	2.48	95.21
1604	1631, M15041	1802	692	1.73	66.36
1616	1616	0	0	0.47	17.85
1631	2-PROPENOIC ACID, 2-TMS-OXY -3- 1-TMS-1H-IND	618	766	1.21	46.30
1641	1624, NU3061	2120	696	2.78	106.59
1659	1659	0	0	0.60	23.09
1665	1665	0	0	0.26	10.03
1731	TREHALOSE PER-TMS	1850	685	0.25	9.50
1745	TREHALOSE PER-TMS	1850	788	0.17	6.63

*The named compound matches the sample peak with a reliability given by "FIT"/1000.

TABLE 33

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION VIII, BEAR URINE
JZ4091:8

	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	38661	0-75
PYRUVIC ACID	0	0-20
GLYCOLIC ACID	0	0-50
ALPHA-OH-BUTYRIC	0.0	0-1
OXALIC	0.0	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	0.0	0-11
5-HYDROXYCAPROIC	0.0	0-1
OCTANOIC	0.0	0-1
BETA-LACTATE	0.0	0-8
SUCCINIC ACID	0	0-20
GLUTARIC ACID	0.0	0-2
2-OXO-GLUTARATE	0	0-210
FUMARIC	0.0	0-5
MALEIC	0.0	0
MALIC ACID	0.0	0-2
ADIPIC ACID	3878.3	0-7
SUBERIC ACID	0.0	0-11
SEBACIC ACID	244.7	0-2
GLYCERIC ACID	0	0-4
BETA-OH-BUTYRIC	89	0-3
METHYLSUCCINIC	0.0	0
METHYLMALONIC	0	0-5
ETHYLMALONIC	********	0-4
HOMOGENTISIC ACID	0.0	0-1
PHENYLPYRUVIC ACID	0.0	0-1
SUCCINYLACETONE	0.0	0-1
3-OH-ISOVALERIC	0.0	0-21
PHOSPHATE	317	0-3000
CITRIC ACID	37	0-450
HIPPURIC ACID	84990	0-2000
URIC ACID	125	0-360
Nutritionals		
KYNURENIC ACID	7544.8	
FORMIMINOGLUTAMIC	0.00	0-3
4-PYRIDOXIC ACID	0.0	0-9
PANTOTHENIC ACID	0	0-30
XANTHURENIC ACID	0.0	0-1
KYNURENINE	0.0	0-1
QUINOLINIC	0.0	0-6
OROTIC ACID	0.00	0-3
D-AM LEVULINIC	0.0	0-18
3-METHYL HISTIDINE	0	0-75
NIACINAMIDE	0.0	0-1
PSEUDOURIDINE	7176	10-220
2-DEOXYTETRONIC	0	0-75
P-HO-PHEN-ACETIC	1019	0-12
XANTHINE	0	0-18
UROCANIC ACID	907	0-3
ASCORBIC ACID	0	0-160
GLYCEROL	8524	0-9
Neurotransmitters		
GABA	0.0	0-1
HOMOVANILLIC ACID	4038.8	0-10
NORMETANEPHRINE	0.0	0-1
VANILLYLMANDELIC	0.0	0-6
METANEPHRINE	374.2	0-2
5-HIAA	6190.5	0-6
MHPG	0.0	0-1
ETHANOLAMINE	3152	10-90
Carbohydrates		
THREITOL	0	0-40
ERYTHRITOL	0	0-55
ARABINOSE	0	0-30
FUCOSE	0.0	0-12
RIBOSE	0.0	0-12
XYLOSE	0	0-70

	mM/M CREATININE	Nrml Range
FRUCTOSE	3266	0-115
GLUCOSE	4435	0-110
GALACTOSE	5127	0-200
MANNOSE	2585	0-70
N-AC-GLUCOSAMINE	11.8	0-3
LACTOSE	4679	0-60
MALTOSE	4470	0-40
XYLITOL	0.0	0-15
ARABINITOL	0.0	0-30
RIBITOL	0.0	0-10
ALLOSE	384.7	0-10
GLUCURONIC ACID	0.0	0-50
GALACTONIC ACID	13137	0-60
GLUCONIC ACID	0.0	0-35
GLUCARIC	42.7	0-5
MANNITOL	604.1	0-15
DULCITOL	0.0	0-10
SORBITOL	603.4	0-10
INOSITOL	0.0	0-12
SUCROSE	18255	0-75
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	0.0	0-1
BUTYRYL GLYCINE	2523.4	0-1
HEXANOL GLYCINE	0.0	0-1
PHENYL PROP GLY	0.0	0-1
SUBERYL GLYCINE	0.0	0-1
ISOVALERYL GLY	********	0-1
TIGLY GLY	0.0	0-1
BETA MET CROT GLY	********	0-1
GLYCINE	9496	0-500
ALANINE	7063	0-130
SARCOSINE	80.5	0-8
BETA-ALANINE	0.0	0-2
B-AMINOISOBUTYRIC	525	0-50
SERINE	10517	0-85
PROLINE	917.5	0-8
HYDROXY PROLINE	12808	0-75
HYDROXY LYSINE	1407.6	0-1
ASPARTIC ACID	1866.1	0-2
ASPARAGINE	0.0	0-2
N-AC ASPARTIC	0.0	0-20
ORNITHINE	1826.4	0-5
GLUTAMIC ACID	364.9	0-6
GLUTAMINE	0	0-210
PIPECOLIC ACID	0.0	0-1
LEUCINE	1200.1	0-9
KETO LEUCINE	913.8	0-1
VALINE	1532.7	0-18
KETO-VALINE	0.0	0-1
ISOLEUCINE	871.7	0-5
KETO-ISOLEUCINE	0.0	0-1
LYSINE	34440	0-35
HISTIDINE	1307	0-225
THREONINE	1240	0-45
HOMOSERINE	0.0	0-1
METHIONINE	********	0-3
CYSTEINE	10527	0-160
HOMECYSTEINE	0.0	0-1
CYSTATHIONINE	0.0	0-1
HOMOCYSTINE	0.0	0-1
CYSTINE	0.0	0-5
PHENYLALANINE	896	0-20
TYROSINE	1136	0-22
TRYPTOPHAN	575	0-25

This sample contained 0.00uMoles Creatinine/7.20ml.

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XT,0850

TABLE 34

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION VIII, BEAR URINE
JZ4091

CONCENTRATION: THIS SAMPLE CONTAINED 0.00 uM CREATININE/mL

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA % OF CREAT
14	13, JZ4051	2321	783	0.61	2309.70
18	13, JZ4051	2321	759	2.92	11073.36
62	SILANE, TRIMETHYLPHENOXY-	1122	877	0.63	2396.66
69	1, 3 PROPANEDIOL DI-TMS	1675	925	2.01	7601.11
74	LACTIC ACID DI-TMS	1510	907	0.65	2452.00
114	104, NJ3031	2131	850	3.43	12980.22
185	BETA-LACTATE DI-TMS	1654	773	0.42	1575.81
189	2-HYDROXY PENTANOIC ACID DI-TMS	141	918	1.13	4290.31
291	291	0	0	1.55	5864.71
354	DIMETHYL MALANIC ACID DI-TMS	171	954	0.82	3110.44
362	TRIMETHYLSILYL ETHER OF GLYCEROL	273	938	0.99	3754.66
622	3-METHYL 2-PENTENEDIOIC ACID DI-TMS	224	892	0.62	2366.22
687	3-METHYL BUTANOATE GLYCINE CONJUGATE TMS	74	628	0.47	1788.05
696	3-METHYL 2-PENTENDIOIC ACID DI-TMS, Z-	222	840	0.47	1778.00
752	GLYCINE, N-3-METHYL-1-OXOBUTYL-N-TMS-, TRIMET	255	942	3.62	13706.16
808	METHYL D3 CREATININE TRI-TMS	1466	743	16.38	62054.19
848	848, JZ4021	2317	887	3.09	11698.73
1104	1104	0	0	3.57	13521.55
1123	1112, M20021	1823	765	0.67	2526.55
1158	3, 4 -DIHYDROXY BENZENEACETIC ACID TRI-TMS	531	834	0.54	2054.74
1196	1189, JZ4051	2322	961	3.87	14654.56
1211	1189, NU3061	2118	697	19.22	72808.71
1232	L-GLUTAMIC ACID, N-ACETYL-N-TMS-, BIS-TMS EST	587	526	2.22	8414.89
1241	P-HYDROXYPHENYL LACTIC ACID TRI-TMS	578	941	9.80	37151.69
1287	HYDROXY PROLINE DI-TMS	1610	424	0.72	2710.46
1370	PALMITIC ACID TMS	335	639	1.07	4055.54
1413	1481, NU3091	2124	403	0.46	1761.13
1506	PARA-HYDROXY HIPPURIC ACID DI-TMS	377	901	1.04	3941.33
1596	PSEUDO URIDINE PENTA-TMS	1779	953	7.00	26509.32
1642	1631, M15041	1802	795	8.81	33369.32
1740	TREHALOSE PER-TMS	1850	781	0.44	1655.34
1746	SUCROSE OCTA-TMS	1080	892	1.40	5286.62

*The named compound matches the sample peak with a reliability given by "FIT"/1000.

87,0860

Table 35

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION IX, BEAR URINE
JZ4101:9

	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	856	0-75
PYRUVIC ACID	52	0-20
GLYCOLIC ACID	7	0-50
ALPHA-OH-BUTYRIC	1.9	0-1
OXALIC	0.0	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	415.0	0-11
5-HYDROXYCAPROIC	0.0	0-1
OCTANOIC	0.0	0-1
BETA-LACTATE	0.0	0-8
SUCCINIC ACID	4	0-20
GLUTARIC ACID	0.0	0-2
2-OXO-GLUTARATE	0	0-210
FUMARIC	7.1	0-5
MALEIC	0.0	0
MALIC ACID	0.0	0-2
ADIPIC ACID	33.7	0-7
SUBERIC ACID	536.8	0-11
SEBACIC ACID	1.1	0-2
GLYCERIC ACID	0	0-4
BETA-OH-BUTYRIC	12	0-3
METHYLSUCCINIC	0.0	0
METHYLMALONIC	0	0-5
ETHYLMALONIC	137.0	0-4
HOMOGENTISIC ACID	0.0	0-1
PHENYLPYRUVIC ACID	110.6	0-1
SUCCINYLACETONE	0.0	0-1
3-OH-ISOVALERIC	1.8	0-21
PHOSPHATE	317	0-3000
CITRIC ACID	136	0-450
HIPPURIC ACID	35604	0-2000
URIC ACID	4	0-360
Nutritionals		
KYNURENIC ACID	297.6	
FORMIMINOGLUTAMIC	0.00	0-3
4-PYRIDOXIC ACID	0.0	0-9
PANTOTHENIC ACID	37	0-30
XANTHURENIC ACID	18.4	0-1
KYNURENINE	19.8	0-1
QUINOLINIC	0.0	0-6
OROTIC ACID	0.00	0-3
D-AM LEVULINIC	20.0	0-18
3-METHYL HISTIDINE	32	0-75
NIACINAMIDE	0.0	0-1
PSEUDOURIDINE	22608	10-220
2-DEOXYTETRONIC	2	0-75
P-HO-PHEN-ACETIC	18	0-12
XANTHINE	6	0-18
UROCANIC ACID	49	0-3
ASCORBIC ACID	2	0-160
GLYCEROL	352	0-9
Carbohydrates		
THREITOL	0	0-40
ERYTHRITOL	0	0-55
ARABINOSE	9	0-30
FUCOSE	41.0	0-12
RIBOSE	41.0	0-12
XYLOSE	3	0-70
FRUCTOSE	14	0-115
GLUCOSE	232	0-110
GALACTOSE	1239	0-200
MANNOSE	35	0-70
N-AC-GLUCOSAMINE	6.5	0-3
LACTOSE	145	0-60
MALTOSE	140	0-40
XYLITOL	0.0	0-15
ARABINITOL	0.0	0-30

	mM/M CREATININE	Nrml Range
RIBITOL	0.0	0-10
ALLOSE	6.4	0-10
GLUCURONIC ACID	38.1	0-50
GALACTONIC ACID	421	0-60
GLUCONIC ACID	4.9	0-35
GLUCARIC	2.9	0-5
MANNITOL	4.1	0-15
DULCITOL	1.0	0-10
SORBITOL	7.7	0-10
INOSITOL	3.9	0-12
SUCROSE	483	0-75
Neurotransmitters		
GABA	8.8	0-1
HOMOVANILLIC ACID	6221.3	0-10
NORMETANEPHRINE	53.6	0-1
VANILLYLMANDELIC	30.3	0-6
METANEPHRINE	156.8	0-2
5-HIAA	4791.4	0-6
MHPG	0.0	0-1
ETHANOLAMINE	211	10-90
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	8.7	0-1
BUTYRYL GLYCINE	0.0	0-1
HEXANOYL GLYCINE	39.1	0-1
PHENYL PROP GLY	0.0	0-1
SUBERYL GLYCINE	0.3	0-1
ISOVALERYL GLY	1852.0	0-1
TIGLY GLY	4.7	0-1
BETA MET CROT GLY	36.8	0-1
GLYCINE	614	0-500
ALANINE	3	0-130
SARCOSINE	1.2	0-8
BETA-ALANINE	0.0	0-2
B-AMINOISOBUTYRIC	232	0-50
SERINE	403	0-85
PROLINE	35.4	0-8
HYDROXY PROLINE	1036	0-75
HYDROXY LYSINE	14.3	0-1
ASPARTIC ACID	105.0	0-2
ASPARAGINE	0.6	0-2
N-AC ASPARTIC	41.4	0-20
ORNITHINE	153.8	0-5
GLUTAMIC ACID	53.2	0-6
GLUTAMINE	40	0-210
PIPECOLIC ACID	0.0	0-1
LEUCINE	62.3	0-9
KETO LEUCINE	533.3	0-1
VALINE	60.8	0-18
KETO-VALINE	0.0	0-1
ISOLEUCINE	49.9	0-5
KETO-ISOLEUCINE	0.0	0-1
LYSINE	16777	0-35
HISTIDINE	452	0-225
THREONINE	69	0-45
HOMOSERINE	0.0	0-1
METHIONINE	254.1	0-3
CYSTEINE	2504	0-160
HOMOCYSTEINE	0.0	0-1
CYSTATHIONINE	0.5	0-1
HOMOCYSTINE	4.3	0-1
CYSTINE	16.5	0-5
PHENYLALANINE	216	0-20
TYROSINE	73	0-22
TRYPTOPHAN	404	0-25

This sample contained 0.02 uMoles Creatinine/7.20ml.

TABLE 36

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION IX, BEAR URINE
JZ4101

CONCENTRATION: THIS SAMPLE CONTAINED 0.00 uM CREATININE/mL

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA % OF CREAT
7	6, JI4081	2189	745	0.67	179.37
10	13, JZ4051	2321	739	0.18	47.76
19	13, AK2011	2044	737	1.17	312.52
66	SILANE, TRIMETHYLPHENOXY-	1122	896	0.29	77.67
71	ETHYL AMINE DI-TMS	22	549	1.79	479.46
78	PROPENE GLYCOL DI-TMS	50	922	0.16	41.63
107	107, JZ4011	2301	849	0.14	37.91
117	104, NJ3031	2131	851	3.34	897.03
122	119, JQ4011	2243	902	0.13	34.73
186	BETA-LACTATE DI-TMS	1654	777	0.41	110.10
293	2-HYDROXY HEXANOIC ACID DI-TMS	1682	784	3.73	1000.76
362	TRIMETHYLSILYL ETHER OF GLYCEROL	273	909	0.50	134.35
383	SILANE, TRIMETHYL 1-METHYLBUTOXY-	1112	493	0.11	30.42
540	539, JZ4041	2320	930	0.29	78.34
613	613	0	0	0.24	63.30
622	3-METHYL 2-PENTENEDIOIC ACID DI-TMS	224	833	0.33	88.13
642	613, JZ4101	2370	711	1.24	332.62
687	BENZENEACETIC ACID, ALPHA - - TMS-OXY, -TRIM	246	889	1.24	332.20
696	3-METHYL 2-PENTENDIOIC ACID DI-TMS, Z-	222	891	1.16	41.93
753	HEXANEDIOIC ACID, 3-METHYL-, BIS-TMS-ESTER	258	663	1.64	440.24
781	HEXANEDIOIC ACID, 3-METHYL-, BIS-TMS-ESTER	258	793	0.18	49.23
798	METHYL D3 CREATININE TRI-TMS	1466	717	0.11	30.11
809	METHYL D3 CREATININE TRI-TMS	1466	701	12.34	3310.78
821	ORTHO-HYDROXYPHENYLACETIC ACID DI-TMS	247	929	0.60	161.70
852	2-HYDROXY 3-PHENYL PROPIONIC ACID DI-TMS	287	921	7.95	2132.51
861	848, JZ4021	2317	685	0.18	47.45
879	HEPTANEDIOIC ACID, BIS-TMS- ESTER	259	905	1.33	355.68
903	PARA-HYDROXY BENZOIC DI-TMS	202	868	0.45	119.54
913	PARA-HYDROXYPHENYLACETIC ACID-DI-TMS	1485	927	0.13	35.95
925	PARA-HYDROXYPHENYLACETIC ACID-DI-TMS	1485	835	13.82	3707.87
930	938, DQ3041	2164	757	0.10	28.08
975	975	0	0	1.18	316.77
986	985, JZ4021	2318	899	0.29	78.99
991	991	0	0	0.15	38.94
1001	OCTANEDIOIC ACID, BIS-TMS-ESTER	306	744	0.36	95.83
1087	HOMOVANILLIC ACID DI-TMS	331	946	2.49	667.03
1103	1104, JZ4091	2369	930	0.43	114.58
1116	1116	0	0	0.53	142.93
1125	1112, M20021	1823	763	4.82	1292.51
1146	HIPPORIC ACID TMS ESTER	103	903	1.02	273.29
1184	1189, JZ4051	2322	954	0.31	82.08
1192	1189, JZ4051	2322	890	0.33	89.21
1200	1189, NU3061	2118	705	0.72	194.06
1211	1189, NU3061	2118	704	5.65	1515.93
1234	L-GLYTAMIC ACID, N-ACETYL-N-TMS-, BIS-TMS EST	587	494	3.37	902.66
1243	P-HYDROXYPHENYL, LACTIC ACID, TRI-TMS	578	951	0.75	201.16
1259	PROPANEDIOIC ACID, TMS-OXY-, BIS-TMS ESTER	594	238	0.52	139.80
1273	HYDROXY PROLINE DI-TMS	1610	349	0.17	46.73
1280	1H-INDOLE-2-CARBOXYLIC ACID, 5-ETHYL-1-TMS-	343	646	0.29	76.62
1289	991, JZ4101	2372	460	1.53	409.12
1332	1332	0	0	0.13	35.00
1354	1354	0	0	0.13	35.22
1364	MANNO-ONIC ACID, LACTONE TETRA-TMS	732	454	0.30	81.30
1371	PALMITIC ACID TMS	335	670	0.91	245.18
1414	1481, NU3091	2124	464	0.60	160.27
1426	SILANE, TRIMETHYL 3-PHENYLPROPOXY-	1158	500	0.19	50.80
1451	BETA AMINO BUTYRIC ACID DI-TMS	89	761	0.22	58.41
1481	TRYPIOPHAN TRI-TMS	1965	477	0.55	146.22
1486	1472, VST031	2031	771	4.74	1271.10
1509	5-HYDROXY INDOLE ACETIC ACID TRI-TMS	592	943	3.19	856.94
1520	STEARIC ACID TMS	434	787	0.14	36.29
1573	6-HYDROXY-HEPTANOIC DI-TMS	1690	275	0.30	79.25
1596	PSEUDO URIDINE PENTA-TMS	1779	746	5.92	1587.71
1628	1472, VST031	2031	799	0.26	69.56
1641	1631, M15041	1802	826	0.87	234.00
1673	1472, VST031	2031	650	1.73	464.94

Table 36, cont.

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUENTS
FRACTION IX, BEAR URINE
JZ4101

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA % OF CREAT
1680	1676, JD2011	2001	624	0.33	87.91
1746	SUCROSE OCTA-TMS	1080	847	0.31	83.08

*The named compound matches the sample peak with a reliability given by "FIT"/1000.

TABLE 37

QUANTIFIED TARGET PANEL
URINE ORGANIC COMPOUNDS
FRACTION X, BEAR URINE
JZ4111:8

	mM/M CREATININE	Nrml Range
Organic Acids		
LACTIC ACID	19433	0-75
PYRUVIC ACID	950	0-20
GLYCOLIC ACID	196	0-50
ALPHA-OH-BUTYRIC	14.8	0-1
OXALIC	36.0	0-25
4-OH-BUTYRIC	0.0	0-1
HEXANOIC ACID	60.0	0-11
5-HYDROXYCAPROIC	12.6	0-1
OCTANOIC	37.4	0-1
BETA-LACTATE	234.1	0-8
SUCCINIC ACID	135	0-20
GLUTARIC ACID	0.0	0-2
2-OXO-GLUTARATE	0	0-210
FUMARIC	21.9	0-5
MALEIC	0.0	0
MALIC ACID	18.8	0-2
ADIPIC ACID	30.4	0-7
SUBERIC ACID	4707.2	0-11
SEBACIC ACID	3.0	0-2
GLYCERIC ACID	30	0-4
BETA-OH-BUTYRIC	321	0-3
METHYLSUCCINIC	0.0	0
METHYLMALONIC	0	0-5
ETHYLMALONI	103.0	0-4
HOMOGENTISIC ACID	0.0	0-1
PHENYLPYRUVIC ACID	347.5	0-1
SUCCINYLACETONE	2.2	0-1
3-OH-ISOVALERIC	1.8	0-21
PHOSPHATE	814	0-3000
CITRIC ACID	46	0-450
HIPPURIC ACID	5949	0-2000
URIC ACID	40	0-360
Nutritionals		
KYNURENIC ACID	6.2	
FORMIMINOGLUTAMIC	0.60	0-3
4-PYRIDOXIC ACID	0.0	0-9
PANTOTHENIC ACID	3	0-30
XANTHURENIC ACID	2.6	0-1
KYNURENINE	70.3	0-1
QUINOLINIC	0.0	0-6
OROTIC ACID	28.54	0-3
D-AM LEVULINIC	541.3	0-18
3-METHYL HISTIDINE	216	0-75
NIACINAMIDE	62.7	0-1
PSEUDOURIDINE	10351	10-220
2-DEOXYTETRONIC	41	0-75
P-HO-PHEN-ACETIC	254	0-12
XANTHINE	14	0-18
UROCANIC ACID	255	0-3
ASCORBIC ACID	1	0-160
GLYCEROL	11477	0-9
Carbohydrates		
THREITOL	7	0-40
ERYTHRITOL	7	0-55
ARABINOSE	25	0-30
FUCOSE	379.6	0-12
RIBOSE	219.1	0-12
XYLOSE	8	0-70
FRUCTOSE	808	0-115
GLUCOSE	432	0-110
GALACTOSE	19	0-200
MANNOSE	406	0-70
N-AC-GLUCOSAMINE	28.8	0-3
LACTOSE	349	0-60
MALTOSE	237	0-40
XYLITOL	27.6	0-15

	mM/M CREATININE	Nrml Range
ARABINITOL	16.0	0-30
RIBITOL	0.0	0-10
ALLOSE	61.7	0-10
GLUCURONIC ACID	239.8	0-50
GALACTONIC ACID	400	0-60
GLUCONIC ACID	11.2	0-35
GLUCARIC	9.0	0-5
MANNITOL	31.5	0-15
DULCITOL	10.6	0-10
SORBITOL	55.4	0-10
INOSITOL	13.6	0-12
SUCROSE	1788	0-75
Neurotransmitters		
GABA	24.8	0-1
HOMOVANILLIC ACID	1673.5	0-10
NORMETANEPHRINE	17.0	0-1
VANILLYLMANDELIC	2.6	0-6
METANEPHRINE	3.1	0-2
5-HIAA	1026.9	0-6
MHPG	1.2	0-1
ETHANOLAMINE	679	10-90
Amino Acids and Glycine Conjugates		
PROPIONYL GLY	16.6	0-1
BUTYRYL GLYCINE	0.0	0-1
HEXANOL GLYCINE	444.9	0-1
PHENYL PROP GLY	243.3	0-1
SUBERYL GLYCINE	4.4	0-1
ISOVALERYL GLY	144.3	0-1
TIGLY GLY	5.7	0-1
BETA MET CROT GLY	353.8	0-1
GLYCINE	2601	0-500
ALANINE	1316	0-130
SARCOSINE	15.4	0-8
BETA-ALANINE	31.3	0-2
B-AMINOISOBUTYRIC	538	0-50
SERINE	2443	0-85
PROLINE	244.2	0-8
HYDROXY PROLINE	3372	0-75
HYDROXY LYSINE	127.6	0-1
ASPARTIC ACID	499.6	0-2
ASPARAGINE	0.2	0-2
N-AC ASPARTIC	13.5	0-20
ORNITHINE	442.4	0-5
GLUTAMIC ACID	6.0	0-6
GLUTAMINE	220	0-210
PIPECOLIC ACID	0.4	0-1
LEUCINE	337.8	0-9
KETO LEUCINE	1066.2	0-1
VALINE	417.4	0-18
KETO-VALINE	1.7	0-1
ISOLEUCINE	274.6	0-5
KETO-ISOLEUCINE	80.6	0-1
LYSINE	2599	0-35
HISTIDINE	203	0-225
THREONINE	377	0-45
HOMOSERINE	0.0	0-1
METHIONINE	20.8	0-3
CYSTEINE	3059	0-160
HOMECYSTEINE	1.0	0-1
CYSTATHIONINE	5.6	0-1
HOMOCYSTINE	59.7	0-1
CYSTINE	9.4	0-5
PHENYLALANINE	233	0-20
TYROSINE	190	0-22
TRYPTOPHAN	130	0-25

This sample contained 0.03 uMoles Creatinine/100 ml.

TABLE 38

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUTENTS
FRACTION X, BEAR URINE
JZ4111

CONCENTRATION: THIS SAMPLE CONTAINED 0.03 uM CREATININE/mL

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA OF CREAT
6	6, JI4081	2189	675	0.71	314.00
9	10, STN031	1893	719	0.65	288.12
12	13, JZ4051	2321	561	0.48	215.50
20	10, M13011	1782	719	2.07	921.84
36	35, JZ4011	2300	847	0.22	97.76
51	42, M20021	1816	726	0.19	83.08
59	49, AK2011	2047	833	0.19	83.56
68	SILANE, TRIMETHYLPHENOXY-	1122	847	0.73	324.60
72	ETHYL AMINE DI-TMS	22	513	2.08	923.09
80	LACTIC ACID DI-TMS	1510	874	1.34	594.49
88	BORATE TRI-TMS	186	.618	0.06	26.27
108	107, JZ4011	2301	847	0.20	90.08
118	104, NJ3031	2131	744	2.49	1108.84
123	119, JQ4011	2243	907	0.30	131.95
166	SILANOL, TRIMETHYL-, CARBONATE 2:1	1429	647	0.07	32.24
186	BETA-LACTATE DI-TMS	1654	781	0.54	241.79
224	92, NA3011	2070	757	0.07	29.54
252	251, JZ4011	2302	848	0.09	39.70
294	4-METHYL 2-HYDROXY PETANOIC ACID DI-TMS	178	807	5.30	2356.51
297	2-HYDROXY HEXANOIC ACID DI-TMS	1682	786	3.49	1551.67
301	291, JZ4091	2368	775	1.56	693.60
336	ETHANOLAMINE TRI-TMS	181	907	0.13	59.44
349	PEAK 459, A02011	1855	511	0.06	26.28
365	TRIMETHYLSILYL ETHER OF GLYCEROL	273	824	1.90	844.99
386	TETRADECANOIC ACID TMS	251	510	0.12	52.53
398	GLYCINE TRI-TMS	1539	869	0.44	197.40
503	SERINE TRI-TMS	322	957	0.51	228.07
540	539, JZ4041	2320	886	0.37	166.09
613	613, JZ4101	2370	855	0.41	182.98
642	1364, JZ4011	2312	370	0.69	307.69
686	BENZENEACETIC ACID, .ALPHA. - -TMS-OXY -, TRIM	246	874	0.19	83.47
753	HEXANEDIOIC ACID, 3-METHYL- BIS-TMS- ESTER	258	758	1.53	678.67
773	SILANE, DIMETHYLPHENOXY TRIMETHYL-	1150	332	0.12	55.52
781	HEPANEDIOIC ACID, BIS-TMS- ESTER	259	624	0.14	60.31
798	METHYL D3 CREATININE TRI-TMS	1466	715	0.04	18.49
809	METHYL D3 CREATININE TRI-TMS	1466	707	4.53	2013.68
822	ORTHO-HYDROXYPHENYLACETIC ACID DI-TMS	247	907	1.04	460.14
856	2-HYDROXY 3-PHENYL PROPIONIC ACID DI-TMS	287	872	7.69	3420.08
880	HEPTANEDIOIC ACID, BIS-TMS- ESTER	259	866	0.95	420.88
907	PARA HYDROXY BENZOIC DI-TMS	202	873	4.41	1959.38
914	PARA-HYDROXYPHENYLACETIC ACID DI-TMS	1485	628	0.94	418.25
928	PARA-HYDROXYPHENYLACETIC ACID DI-TMS	1485	811	9.47	4211.72
938	1234, JZ4061	2333	444	0.07	32.28
946	HEXANOYL GLYCINE DI-TMS	1656	724	0.19	83.16
971	975, JZ4101	2371	813	0.23	100.98
976	975, JZ4101	2371	877	2.17	964.67
987	985, JZ4021	2318	756	0.18	81.73
992	991, JZ4101	2372	814	0.20	88.90
996	SUBERIC ACID DI-TMS	1633	520	0.05	21.95
1003	OCTANEDIOIC ACID, BIS-TMS- ESTER	306	726	2.12	940.43
1010	1062, NJ3051	2135	474	0.37	163.67
1015	561, LB1031 VALPROIC ACID METABOLITE, MSL	1973	527	0.55	246.28
1031	SILANE, TRIMETHYL PHENETHYLTHIO-	1161	389	0.23	102.67
1046	SEBACIC ACID, BIS-TMS- ESTER	393	612	0.36	160.75
1060	975, JZ4101	2371	704	0.04	19.97
1068	HYDROCINNAMIC ACID, P-TMS-, TRIMETHYLSILYL ES	288	688	0.28	126.21
1081	1160, JG4021	2179	315	0.37	164.16
1088	1062, NJ3051	2135	770	1.35	599.54
1095	1332, JZ4101	2374	598	0.39	172.38
1103	1104, JZ4091	2369	784	0.06	26.57
1116	1116, JZ4101	2373	861	0.86	382.04
1124	1112,M20021	1823	804	0.34	149.94
1133	877, JK4071	2237	414	0.28	125.70
1138	975, JZ4101	2371	386	0.41	181.50
1145	HIPPURIC ACID TMS ESTER	103	779	0.13	59.11

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TABLE 38, cont.

METABOLIC SCREENING LABORATORY
URINE ORGANIC CONSTITUTENTS
FRACTION X, BEAR URINE
JZ4111

PEAK #	CONSTITUENT'S BEST MATCH FROM LIBRARY*	LIB ENTRY	FIT vs 1000	AREA %	AREA OF CREAT
1157	ORNITHINE N5, N5 TETRA-TMS	1536	836	0.13	57.72
1164	FRUCTOSE PENTA-TMS	881	660	0.18	79.07
1169	TETRADECANOIC ACID TMS	251	789	0.17	75.71
1175	METHYL ALPHA-GLUCOSIDE TETRA-TMS	790	410	0.30	134.71
1187	24, AK2011	2045	508	0.23	103.04
1199	1189, JZ4051	2322	828	3.17	1408.37
1213	1189, NU3061	2118	676	6.41	2850.85
1222	SEBACIC ACID, BIS-TMS- ESTER	393	521	0.07	31.48
1227	META-HYDROXYPHENYL ACETIC ACID DI-TMS	248	274	0.21	91.70
1234	ACETIC ACID, PHENOXY-, TRIMETHYLSILYL ESTER	66	481	0.60	265.32
1255	GALACTOSE PENTA-TMS	878	571	0.69	304.74
1263	996, JZ4061	2329	391	0.08	37.07
1279	1H-INDOLE-2-CARBOXYLIC ACID, 5-ETHYL-1-TMS-,	343	445	0.11	49.11
1288	INDOLE 2-ACETIC ACID 1-TMS, TMS-ESTER	316	858	2.51	1117.19
1302	GL1021, 678	1964	451	0.32	140.03
1309	1H-INDOLE-3-ETHANAMINE, N, 1-BIS-TMS-5- TMS-OX	547	565	0.27	119.16
1334	3-HYDROXYTETRADECENEDIOIC ACID I	1708	420	0.13	59.54
1344	1H-INDOLE-5-CARBOXYLIC ACID, 1-TMS-, TRIMETHY	266	441	0.38	170.74
1355	D-MANNOPYRANOSE PENTA-TMS	892	905	0.43	192.76
1371	PALMITIC ACID TMS	335	892	0.77	340.90
1398	GALACTURONIC ACID PENTATMS	915	629	0.07	31.57
1406	1246, JZ4061	2334	434	0.24	108.11
1411	1032, M15041	1796	335	0.04	19.48
1423	988, NE3031	2088	407	0.13	57.19
1443	1300, JZ4071	2356	465	0.09	37.89
1455	DODECENEDIOIC ACID DI-TMS, CIS?	1695	433	0.07	31.96
1489	1472, VST031	2031	694	4.88	2167.24
1502	OLEIC ACID, TRIMETHYLSILYL ESTER	1614	677	0.13	56.05
1509	5-HYDROXY INDOLE ACETIC ACID TRI-TMS	592	889	0.36	159.16
1520	STEARIC ACID TMS	434	728	0.55	244.65
1529	982, N03031	2142	405	0.12	53.30
1537	3-HYDROXYDODECANEDIOIC ACID-TMS-3	1776	708	0.05	20.19
1546	996, GI1021	1958	448	0.27	118.50
1558	HEPTANEDIOIC ACID, 4-OXO-, BIS-TMS ESTER	305	381	0.12	54.63
1562	1472, VST031	2031	635	0.07	32.52
1596	PSEUDO URIDINE PENTA-TMS	1779	690	2.10	933.44
1603	988, OK1041	1990	574	0.09	40.28
1609	1472, VST031	2031	552	0.04	19.08
1612	251, JZ4011	2302	365	0.06	24.80
1620	D-GALACTOSE, 2-AMINO-2-DEOXY-3, 4, 5, 6-TETRAKIS	746	406	0.07	33.22
1628	1472, VST031	2031	729	0.55	246.19
1652	1472, VST031	2031	713	0.14	62.64
1664	1631, M15041	1802	567	0.09	41.81
1674	1669, P17031	1984	687	2.27	1011.28
1680	1472, VST031	2031	463	0.08	33.58
1686	1189, JZ4051	2322	252	0.06	25.53
1692	1073, RT1051	2040	395	0.05	22.18
1701	2-HYDROXYTETRADECENEDIOIC ACID	1704	385	0.08	36.13
1728	533, LB1031 VALPROIC ACID METABOLITE, MSL	1972	409	0.04	19.96
1746	SUCROSE OCTA-TMS	1080	888	0.73	324.31
1795	LACTOSE OCTA-TMS	1854	785	0.08	36.36
1839	1785, YD1011	1875	414	0.06	25.81

*The named compound matches the sample peak with a reliability given by "FIT"/1000

Further Purification of MNC in Fraction VI Using HPLC

Fraction VI was further purified using HPLC. After lyophilization and reconstitution in methanol, aliquots of Fraction VI were loaded onto a HPLC using a C_{18} column. A gradient of 0.1M ammonium formate and a 9:1 mixture of acetonitrile/water was the solvent system used for further separation of Fraction VI. Four peaks were visualized using a UV-Vis detector. Based on the increased absorbance at 220 nm, 230 nm, and 280 nm, four fractions were collected.

Peak 3 was further purified by HPLC using an isocratic solvent system. A representative tracing from HPLC of repetitive injections of Peak 3 recorded at wavelengths of 220 nm, 230 nm, and 280 nm. Both peaks were collected and labeled as 3A and 3B respectively.

Peak 4 was further purified by HPLC using a gradient system. It was detected by increased UV absorbance readings at 220 nm, 230 nm, and 280 nm. Peak 4 was separated into two peaks and collected as Fractions 4A and 4B.

Submission of HPLC Fractions for Analysis by Nuclear Magnetic Resonance (NMR) and Mass Spectrometry (MS)

Fractions labeled as 3A and 3B were submitted to NMR and MS using chemical ionization and electron ionization. The molecular weight of Fraction 3A is estimated to be 279. Interpretation of the NMR spectra suggests a phenolic compound.

Fraction 3B has a molecular weight of 209 with an empirical formula consisting of $C_{10}H_{11}NO_4$. The substance para-hydroxyphenylacetylglycine has a similar molecular weight of 209. However, NMR data do not support the theory that para-hydroxyphenylacetylglycine exists in the MNC complex. An ester structure found by NMR in the MNC complex is not found in the structure of para-hydroxyphenylacetylglycine. Also, para-hydroxyphenylacetylglycine has been only detected in Fraction VI.

Data from NMR support the conclusion that Peak 4 contains both an indole structure and a phenol structure.

Summary

1. MNC from Fraction VI has been further purified using gradient and isocratic HPLC into compounds 1, 2, 3A, 3B, 4A, and 4B.

2. The molecular weight of compound 3B is known at 209 ($C_{10}H_{11}NO_4$).

3. One structure with a molecular weight of 209 has been found in Fraction VI. It has been identified as para-hydroxyphenylacetylglycine.

4. However, a unique compound with a phenylester structure and having an empirical formula of $C_{10}H_{11}NO_4$ best corresponds to the data accumulated from NMR.

5. Thus, a unique substance (which is part of the MNC complex associated only with the denning phenomenon) is found in Fraction VI. This unique substance also contains significant biopotential for stimulation of osteoblasts.

ANTICIPATED TREATMENT RESULTS

Based upon studies with guinea pigs, bone cultures, black bears, and polar bears, the anticipated results of BDI treatment in humans follow.

Osteoporosis

Successful treatment of females or males suffering from osteoporosis or prevention of bone loss in them or in astronauts will be due to stimulation of osteoblasts (the cells that form bone), inhibition of resorption activity of osteoclasts, or simultaneous effects of osteoblasts and osteoclasts.

Thus, BDI becomes a potent, naturally occurring component to not only prevent osteoporosis but to increase size and strength of bone and successfully treat the debilitating condition of osteoporosis.

These changes may be evaluated by a general medical examination and optional diagnostic evaluations including radiographic assessment, measurement of the density of

vertebral and other bones, prevention of bone fractures, and special assessment of skeletal remodeling activity.

Kidney Disease

Patients with chronic kidney disease or end stage renal failure may be treated so that the recycling of excess urea back into protein would result in the symptoms of kidney failure being reduced or abolished, to the extent that dialysis or kidney transplantation would not be needed.

Burns and Trauma

The prevention of excessive loss of protein from non-involved muscle and other tissues would treat patients with severe burns and trauma.

Muscle Atrophy

This treatment may maintain muscle mass in humans as they age and may prevent loss of muscle tissue in astronauts.

Obesity and Other Eating Disorders

The interfacing of increasing deposition of healthy lean tissue while eating less would have a pronounced favorable effect on the treatment of obesity in human beings. When the effective dose of BDI is adjusted for safety and to a degree that it promotes less food intake to a point of complete absence while preserving lean tissues, treatment of one of the most resistant disorders of human beings may be accomplished.

An anticipated treatment result, based on studies of hyperphagic black bears, would be to stimulate food intake in humans suffering from poor food intake such as anorexia nervosa.

General Health

In humans, the overall effects of BDI are expected to enhance general health while substantially reducing cost of health care.

PREDICTABILITY AND CORRELATABILITY OF COMPARABLE RESULTS IN HUMANS

While *in vivo* tests have not been made with regard to bone remodeling by the bear derived isolate of claim 1, *in vitro* tests have been done. Such *in vitro* tests are set forth in a recent April 1994 draft publication by the FDA. The publication is entitled "Guidelines for Pre-Clinical and Clinical Evaluation of Agents Used in the Prevention or Treatment of Post Menopausal Osteoporosis". The draft was prepared by The Division of Metabolism and Endocrine Drug Products of the FDA, as indicated in April of 1994. The following shows a comparison between the guidelines (Page 4, Section IV) and results achieved with BDI.

Suggested FDA Guidelines	BDI Test Results
1. At least one biochemical marker of bone resorption.	1. BDI isolated from summer fasting urine inhibits the production of tartrate resistant acid phosphatase in mouse calvaria organ cultures. Tartrate resistant acid phosphatase is produced by osteoclasts and serves as a sign of bone resorption (Lau, et al., 1987; Delmas, 1988).
2. At least one biochemical marker for bone formation.	2. When added to an organ (bone) culture of mouse calvaria, BDI isolated from winter denning urine or from summer fasting urine produced a statistically significant production of alkaline phosphatase which represents stimulation of osteoblasts (Aurback, Marx, et al., 1992; Delmas, 1988, 1993; Mundy, Roodman, 1991; Parviainen, Pirskanen, 1991; Stein, Lian, 1990, 1993; Quarles, Yokay, et al., 1992).
3. That alkaline phosphatase is the suggested biochemical marker for bone formation.	3. When BDI was broken down into ten individual fractions, fractions V, VI, and VII proved to be the most potent in stimulating statistically significant production of alkaline phosphatase by osteoblasts located in the bone of mouse calvaria.

4. A suggested biochemical marker of bone resorption is urinary pyridinium crosslinks.	4. Rather than using an indirect method to assess bone resorption, our studies have shown that BDI inhibits resorption in two ways - the conversions of bone marrow monocytes into osteoclasts, and by the inhibition of osteoclasts already functioning in bone resorptive cavities.
5. Measurement of serum osteocalcin (a specific marker of bone formation) is encouraged.	

The foregoing results confirm *in vitro* bone remodeling consistent with the FDA outlined guidelines. Ongoing *in vivo* studies have confirmed the following.

Pre-Clinical *in vivo* Studies

1. Study conducted in an *in vivo* model such as the ovariectomized, osteoporotic rat.	1. When compared with the untreated, osteoporotic ovariectomized rat, ovariectomized rats that had been treated with DBI showed a 16-fold increase in bone mineral density of the femoral bone and a 4-fold increase in the vertebral bones when compared with bone mineral density of humans receiving therapeutic estrogen therapy over the same or trial period.
2. Histomorphometry or measurement of serum osteocalcium (a specific marker of bone formation) is encouraged.	2. Histomorphometry of the femoral and vertebral bones from the DBI treated, ovariectomized, osteoporatic rats is now underway.

The foregoing *in vivo* studies correlate with the FDA guidelines.

In addition, the subject matter of claim 1 has the ability to modulate the urea to creatinine ratio in urine of the guinea pig to values of 10 or less. Thus, tests were affirmative, and indicative of an increased ability of the guinea pig to recycle urea (Table 16). Bone mineral density in ovariectomized rats increased when those rats were treated with the subject matter of claim 1.

Nelson, Jones, et al. (1975) showed that urea is continually produced in the denning bear. Since the bear doesn't urinate, urea levels in blood, if unchecked, would result in high levels of urea (uremia) and death. Ahlquist, Nelson, et al. (1984) and Wolfe, Nelson et al. (1982, 1982a) showed that uremia is prevented by recycling the newly formed urea almost immediately back into protein from which it came. Nitrogen from urea was split off and attached to glycerol released from stored fat in adipose tissue. The newly formed amino acids were then incorporated in proteins such as albumin and fibrinogen.

Nelson, Beck, et al. (1984) showed that the rapid recycling of urea resulted in a decline of the level of urea in blood. When expressed as a ratio of urea to creatinine, the ratio decreased from 20 or more to less than 10. Such ratios were only found in denning bears who were not drinking or urinating. In catheterized urine specimens of denning bears, Nelson, Wahner, et al. (1973) showed when urea recycling was in process, the urea to creatinine ratio in urine was also reduced to values less than 10.

When BDI was injected into guinea pigs, urine U/C was decreased to values less than 10 indicative of similar urea recycling in guinea pigs as shown by denning bears.
A strong indicator of suitability of bear originated materials for pharmacologic use in humans is the use of the bile salt produced by the bear, ursodeoxycholic acid (UDCA).

1. UDCA is safe and effective therapy for patients with cholesterol gall stones (Rubin, Kowalski, et al., 1994).

2. UDCA currently offers the best combination of efficacy and lack of side effects in treatment of primary biliary cirrhosis and reduces the need for liver transplants (Lim, Northfield 1994; Poupon, Poupon, et al., 1994).

3. UDCA improves liver function in primary sclerosing cholangitis of the liver (Jazrawi, De Coestecker, et al., 1994).

4. UDCA is a safe, well-tolerated, and efficacious treatment of refractory chronic graft versus host disease of the liver occurring in patients receiving bone marrow transplants (Fried, Murakawi, et al., 1992).

5. UDCA is a bear derivative acceptable and approved to be administered to humans.

Accordingly, it is extrapolated that if one bear derivative is administered pharmaceutically to humans as a pharmacological product, another bear derivative will be similarly acceptable. This acceptability is reinforced by the cited tests with guinea pigs.

In summary, the conclusion reached after many years of study, observation of the phenomenon of bears, and predicated upon numerous publications set forth in the bibliography filed with this application, the predictability and correlatability to comparable results when administered to humans is present within the confines of the current disclosure.

OTHER INVESTIGATIONS

In addition to those described, investigations relating the close proximity of the BDI isolate with other normally appearing metabolic substances suggests that they are required to achieve action. Thus, BDI, the bear derived isolate alone, may require other metabolites to exert its action. Further portions of the entirety of the isolate may be combined or absorbed into these substances to exert action. This equivalency may be a function of these interactions and substantially produce the same result.

<u>Summary of Present Discovery and Areas for Further Research</u>

Already achieved as set forth above is the discovery of how the bear forms bone, even though existing in a state similar to post-menopausal women. The discovery reveals that BDI inhibits bone resorption by inhibiting the maturation of osteoclasts from bone marrow monocytes and by directly inhibiting functioning osteoclasts. The discovery has

confirmed that a unique feature of BDI is that rather than inhibiting osteoblasts as current drugs do (and thus reducing bone production), BDI independently stimulates osteoblasts to form bone. Even though the bear inhibits osteoclasts, at the same time it independently stimulates osteoblasts to form bone. This novel, unique approach of direct osteoblast stimulation by BDI has been shown in cell and organ bone cultures. When current drugs on the market inhibit bone resorption by osteoclasts, osteoblast numbers and activity are also inhibited. BDI's unique abiltiy to directly stimulate osteoblastic proliferation is demonstrated. Moreover, BDI directly stimulates fibroblastic activity which involves the matrix formation and production of bone stimulating factors. Again, no drugs on the market have this action. Finally, BDI stimulates bone formation in the ovariectomized rat, a model similar to post-menopausal women.

GC/MS has established the identifiable ingredients present in BDI. Using countercurrent chromatography (CCC), fractions were developed that separated BDI into semi-purified fractional components that affect osteoblasts, osteoclasts, and fibroblasts. These discoveries include the potent Fractions V, VI, and VII that stimulate osteoblast and fibroblast proliferation and bone formation by osteoblasts. This is to the exclusion of the inhibition of osteoblastic activity of BDI found in Fraction III. Moreover, the discoveries of the constitutents of Fractions V, VI, and VII by first producing them by CCC and then by determining their composition and concentration by GC/MS has led to further investigations. This includes the fact that bone resorption inhibiting activity of BDI is found mainly in the first three fractions of BDI as produced by CCC. Also, Fraction III inhibits osteoblasts directly.

Additionally, the potency of Fractions V, VI, and VII on forming bone in the osteoporotic rat can be calculated from the *in vivo* rat studies, the *in vitro* organ cultures of mouse calvarial bone and the cell cultures of osteoblasts.

Future Investigations

What is thus required is the following:

The combined potency of Fractions V, VI, and VII of BDI needs to be determined. This may result in the discovery of a unique substance that orchestrates all of the bone forming activity of BDI or in the fact that BDI represents a novel and unique combination of previously known as well as recently discovered new compounds. This substance or combination will be tested using *in vitro* and *in vivo* methods. This novel and unique substance or combination of substances will be synthesized and tested for bone forming activity in a model of the post-menopausal human, ovariectomized rats.

Other Bear Species

The effects of BDI as related to urea recycling extend from the black bear to include grizzly and polar bears. Both of these species demonstrate urea recycling as shown by a low blood urea to creatinine ratio when not drinking water or eating snow. No other mammal has this ability. If not drinking water, or if water is withheld, all other animals show an increase in blood urea and dehydration. Their urea to creatinine ratio rises above 20 and death will occur if water is not taken. Because of the effective urea recycling process, when not drinking or eating, black, grizzly, and polar bears protect their lean body mass, behave normally, and can be physically active. Since BDI induces denning phenomenon in guinea pigs (including urea recycling), BDI can be predicted to be similar in effects if obtained from urine or blood from grizzly or polar bears.

SCOPE OF THE INVENTION

It will be understood that within the scope of the invention as expressed in the appended claims, various changes in the details and materials which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.